**From:** Barbara Ritchie <BARBARA.RITCHIE@fmc.com>
**Sent:** Friday, March 14, 2014 2:54 PM
**To:** Rochlin, Kevin
**Cc:** Sheldrake, Beth; Greutert, Ed [USA]; Kelly Wright; susanh@ida.net; Bruce.Olenick@deq.idaho.gov; Douglas.Tanner@deq.idaho.gov; Scott.Miller@deq.idaho.gov; Jeff Hamilton; Marguerite Carpenter; David Heineck; Marc Bowman; Michael Steiner; 'Rob Hartman'
**Subject:** RE: Comments on the Data Gap Report
**Attachments:** 2014-03-14 FMC Responses to EPA Comments on the Data Gap Report for the ....pdf; 2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**Categories:** Lepic 3-22 to 4-4, Lepic 2/22 to 3/22, COPIED TO LEPIC FOLDER ALREADY

Kevin,

Please find attached FMC's responses to the EPA comments on the Data Gap Report for the FMC OU received from EPA on February 20, 2014 as well as a revised copy of the Data Gap Report with the changes shown highlighted in yellow. Revised Figures 2-2 and 4-1 and minor pagination changes are not highlighted.

Any questions, please advise.

---

**From:** Rochlin, Kevin [mailto:rochlin.kevin@epa.gov]
**Sent:** Monday, March 03, 2014 11:17 AM
**To:** Barbara Ritchie
**Subject:** RE: Comments on the Data Gap Report

Your request for an extension is approved.

Kevin

_____

From:

**Kevin Rochlin** | **Superfund Remedial Project Manager**
**U.S. Environmental Protection Agency** | **Region 10**
**Office of Environmental Cleanup**
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---

**From:** Barbara Ritchie [mailto:BARBARA.RITCHIE@fmc.com]
**Sent:** Thursday, February 27, 2014 7:40 AM
**To:** Rochlin, Kevin
**Subject:** RE: Comments on the Data Gap Report

Kevin,

As per my voice message, the UAO would appear to require us to respond to the comments you provided on the Data Gap Report within 15 days, which would be 3/5/14. FMC requests your approval of an extension until 3/14/14 to submit a response to these comments and a revised Data Gap Report.

Please confirm your approval.

---

**From:** Rochlin, Kevin [mailto:rochlin.kevin@epa.gov]
**Sent:** Thursday, February 20, 2014 12:49 PM
**To:** Barbara Ritchie
**Cc:** Douglas.Tanner@deq.idaho.gov; Greutert, Ed [USA]; Kelly Wright; Scott Miller - Idaho DEQ (Scott.Miller@deq.idaho.gov); Stifelman, Marc; susanh@ida.net; Zavala, Bernie
**Subject:** Comments on the Data Gap Report

See attached file.

Kevin Rochlin

---

From:

**Kevin Rochlin** | **Superfund Remedial Project Manager**
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FMC

## FMC Idaho LLC, Pocatello, Idaho

### REMEDIAL DESIGN
# DATA GAP REPORT for the FMC OU

March 2014

MWH

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# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| ASTM | American Society of Testing and Materials |
| bgs | below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| cm/sec | centimeters per second |
| DGWP | Data Gap Work Plan |
| EPA | U.S. Environmental Protection Agency |
| ET | evapotranspirative |
| ft | feet |
| in. | inch |
| IRODA | Interim Record of Decision Amendment |
| LL | liquid limit |
| meq | molar equivalent |
| MDD | maximum dry density |
| mg/kg | milligrams per kilogram |
| mmhos | micromohs |
| OMC | optimal moisture content |
| OU | operable unit |
| $lbs/ft^3$ | pounds per cubic foot |
| PI | plasticity index |
| PL | plastic limit |
| RA | remediation area |
| RAO | remedial action objective |
| RDRA | Remedial Design/Remedial Action |
| RDWP | Remedial Design Work Plan |
| SB | soil boring |
| SFS | Supplemental Feasibility Study |
| SRI | Supplemental Remedial Investigation |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TP | test pit |
| UAO | Unilateral Administrative Order |
| WUA | Western Undeveloped Area |

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# 1.0 INTRODUCTION

As specified in the *Interim Amendment to the Record of Decision for the EMF Superfund Site FMC Operable Unit* (IRODA; EPA 2012), the selected soil remedy for the FMC OU includes the construction of soil covers over specified remediation areas (RAs). Two soil cover designs are specified: gamma cap and evapotranspiration (ET) cap. The preliminary designs for these soil covers are summarized below:

- The ET soil cover design consists of a minimum cover thickness of 24 inches of soil that will provide sufficient water storage and an additional 6 inches of soil to address potential long-term erosion of the cover. The design basis is presented in the *Comparison of Conventional and Alternative Capping Systems for Use at the FMC Plant OU (Capping Memorandum*) contained in Appendix D of the *Supplemental Feasibility Study Report for the FMC Plant Operable Unit* (*SFS Report,* MWH, 2010).

- The gamma soil cover consists of a nominal 12 inches soil and is expected to provide sufficient gamma shielding from underlying fill materials. As described in the Remedial Design Work Plan (RDWP; MWH, 2013a), a gamma cap performance evaluation will be detailed in the separately-submitted Gamma Cap Performance Evaluation Work Plan.

The selected remedy requires approximately 155 acres of ET soil covers and 340 acres of gamma soil covers. The soil to be used for construction of both types of covers will be removed from the Western Undeveloped Area (WUA), an area of the westernmost portion of the FMC Plant OU that was never used in the phosphorus manufacturing process. Additional site-specific soil data from the WUA is required to proceed with cover design. This report details the additional soil sampling and material (geotechnical) testing that was performed to better define the volume of available borrow soil and its material properties to finalize the design of the soil covers.

As specified in the IROD, the selected groundwater remedy for the FMC OU includes groundwater extraction and treatment, with treatment either at the City of Pocatello POTW or by a water treatment facility built within the FMC OU. The latter alternative would discharge treated water to an infiltration basin, from which it would either percolate down to groundwater or evaporate to the atmosphere. FMC is evaluating both of these treatment options. This report describes the collection of soil percolation data that was performed to support the evaluation and potential design of the onsite percolation/ evaporation basin(s).

Another remedial action requirement of the IROD is that elemental phosphorus residues that may remain in underground 16-inch, reinforced concrete storm/sewer piping in RA-A must be removed and disposed of offsite. This report presents the procedures used to perform a video survey of that underground storm drain piping to better understand the volume of residual solids it contains and support design of this element of the remedial action.

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## 1.1 REGULATORY BACKGROUND

On June 10, 2013, EPA Region 10 issued a Unilateral Administrative Order to FMC for Remedial Design and Remedial Action (UAO for RD/RA, or UAO; EPA 2013), EPA Docket No. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-10-2013-0116. The UAO for RD/RA requires FMC to implement the interim remedial actions that EPA selected in its September 27, 2012 Interim Record of Decision Amendment for the FMC OU ("IRODA"). FMC is implementing the selected remedy in accordance with the UAO.

As summarized in Section 3 of the RDWP a data gap investigation was performed between October 29th to November 13th, 2013 to collect site specific data to support the RD as defined in of Section IX, Paragraph 30 a. and 30 b. of the UAO. This Data Gap Report summarizes the investigations performed and testing completed in accordance with the Data Gap Work Plan (DGWP; MWH, 2013b) that was approved by EPA on October 22, 2013.

## 1.2 FMC SITE DESCRIPTION

A description of the FMC OU is presented in Section 2 of the RDWP. A site map showing the FMC OU RAs and WUA is provided on Figure 1-1.

## 1.3 PURPOSE AND SCOPE OF REPORT

This report has been developed to provide the following:

1. Summarize the site investigations and material testing performed as per the DGWP;
2. Present the results of soil testing performed on samples collected from the WUA, including properties (geotechnical, hydrological, agronomical, vegetative) to support design of the ET soil covers and evaluate potential design of the infiltration basin option for managing treated groundwater;
3. Provide an estimate of the availability of borrow soil within the WUA for cap construction;
4. Present the results of the RA-A stormwater sewer survey; and
5. Provide an estimate of the root density expected based on the vegetation trial plot survey.

## 1.4 DOCUMENT ORGANIZATION

The remainder of this Data Gap Report consists of the following:

- Section 2.0 Data Gap Field Investigations – Presents a summary of the field investigations performed per the DGWP.
- Section 3.0 Laboratory Testing – Presents a summary of the laboratory testing performed on samples collected during the field investigation.

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- Section 4.0 Data Gap Investigation Results – Presents the results of the field investigation, including a summary of soil property testing, root density testing, and the stormwater sewer video survey.
- Section 5.0 contains references.
- Appendix A: Field Investigation Photographs
- Appendix B: Test Pit Logs
- Appendix C: Soil Boring Logs
- Appendix D: Geotechnical and Hydrological Testing Reports
- Appendix E Agronomic Testing Reports
- Appendix F: Root Density Testing Reports
- Appendix G: RA-A Stormwater Sewer Decontamination Waste Determination Laboratory Reports and DVD of Video Survey
- Appendix H: ProUCL 5.0 Statistical Analysis

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# 2.0 DATA GAP FIELD INVESTIGATIONS

A variety of field investigations were performed during October 29th to November 13th per the DGWP and included the following:

- Excavation of 10 test pits within the WUA;
- Drilling of 5 soil borings within the WUA;
- Video survey of stormwater sewer piping in RA-A; and
- Collection of soil samples from the FMC vegetation trial plot.

A description of the above investigations is provided below. Photographs taken during the field investigations are presented in Appendix A.

## 2.1 WESTERN UNDEVELOPED AREA INVESTIGATIONS

A focused investigation was performed in the WUA consisting of test pits and soil borings. Test pit and soil boring locations are presented in Figure 2-1 and a summary of the investigations are presented in Table 2-1. Test pit and soil boring logs from the WUA are presented in Appendix B and C, respectively.

**Table 2-1 Summary of WUA Soil Investigation**

| Test Pit/Soil Boring I.D. | Total Depth (feet bgs) | Depth of Gravel (feet bgs) | Maximum Depth of Grab Sample | Sample Depths/Intervals |
|---|---|---|---|---|
| TP001 | 15.7 | 15.7 | 10 | Grab samples collected at 1 foot intervals down to 10 feet. |
| TP002 | 17.3 | NC[a/] | 10 | Grab samples collected at 1 foot intervals down to 10 feet. |
| TP003 | 4 | 4 | 3 | Grab samples collected at 1 foot intervals down to 10 feet. |
| SB003 | 31.5 | 2.0 | 15 | Undisturbed sample collected at 0 to 2 feet (bgs), and disturbed sample collected 2 to 15 feet. |
| TP004 | 18 | NC[a/] | 10 | Grab samples collected at 1 foot intervals down to 10 feet. |
| SB004 | 31.5 | 23.5 | NA | Undisturbed samples collected at 2 to 4 and 6 to 8 feet (bgs). |

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| Test Pit/Soil Boring I.D. | Total Depth (feet bgs) | Depth of Gravel (feet bgs) | Maximum Depth of Grab Sample | Sample Depths/Intervals |
|---|---|---|---|---|
| TP005 | 20.5 | NC[a/] | 11 | Grab samples collected at 1 foot intervals down to 10 feet. |
| TP006 | 17.1 | NC[a/] | 10 | Grab samples collected at 1 foot intervals down to 10 feet. |
| SB006 | 31.5 | 21.1 | NA | Undisturbed samples collected at 2 to 4, 6 to 8 feet (bgs). |
| TP007 | 19.8 | NC[a/] | 10 | Grab samples collected at 1 foot intervals down to 10 feet. |
| SB007 | 31.5 | 24.5 | NA | Undisturbed samples collected at 2 to 4, 6 to 8, and 12 to 14 feet (bgs). |
| TP008 | 19.8 | NC[a/] | 10 | Grab samples collected at 1 foot intervals down to 10 feet. |
| SB008 | 31.5 | 30.0 | NA | Undisturbed samples collected at 2 to 4 and 6 to 8 feet (bgs). |
| TP009 | 12.3 | 7.5 | 7 | Grab samples collected at 1 foot intervals down to 10 feet. |
| TP010 | 9.0 | 6.0 | 6 | Grab samples collected at 1 foot intervals down to 10 feet. |

**Notes:**
[a/] NC = gravels not contacted in test pit before maximum depth of the excavator was reached.

### 2.1.1 Test Pits

A total of ten (10) test pits (TP001 through TP010) were excavated throughout the WUA. Grab soil samples were collected from each test pit at approximately 1-foot intervals down to 10 feet or until gravels were contacted and composited to provide 2 5-gallon buckets of representative soils from each location per the Work Plan. The test pits were excavated to various depths ranging from 7 to 20 feet below ground surface. Soils encountered in the test pits were predominantly loess silt (silt) overlying gravels. The depth of silts ranged from 4 to 20.5 feet deep with the majority of test pits encountering silt down to at least 15 feet. Depth measurements were completed at the base of the test pit and in any test pits where gravels were contacted. As indicated by the test pitting and confirmed by the subsequent soil borings, shallow

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gravel was contacted in TP003, TP009, and TP010 at depths ranging between 4 and 7 feet bgs. This gravel deposition appears to bisect the WUA in an east-west direction, generally shallower on the east end and deeper on the west end. Additional exploratory borings were also excavated, without samples being collected on the north and south sides of TP003, TP009, and TP010 to define the lateral extent of the gravel lense. Visual observations during the exploratory borings indicate that there is a sharp drop in depth of the gravels at an approximate distance of 300 feet on either side of the test pits where gravel was contacted. The field investigation (including test pits and soil borings) adequately characterized the extent of the shallow gravels for assessing the amount of soil available for use as capping soil in the WUA.

### 2.1.2 Soil Borings

Five soil borings (SB003, SB004, SB006, SB007, and SB008) were collocated within 20 feet of five test pit locations (TP003, TP004, TP006, TP007, and TP008) and drilled to depths ranging up to 31.5 feet. The purpose of the soil borings were to collect undisturbed samples of the silt, to characterize the general depth of gravels underlying the silts, and collect disturbed samples of the gravel. Undisturbed samples of the silts were collected at SB003, SB004, SB006, SB007, and SB008 using a Shelby tube at depths of 0 to 2-feet, 2 to 4-feet and 6 to 8-feet with one sample collected at 12-14 feet. The undisturbed silt sample was collected at 0 to 2-feet at SB003, but no deeper samples were collected, due to the presence of gravels at 2 feet and below. The sample at 12-14 feet was collected at SB007 to provide additional information related to the in-situ hydraulic conductivity of the silts at deeper depths. One grab sample of the gravels recovered from the auger during drilling from 2 to 15 feet bgs in SB003 was also collected for laboratory permeability analysis. Based on visual observation, the underlying gravels size was predominantly 3-inch minus and were metamorphic in nature.

The DGWP specified that gravel samples would be collected at a depth approximately 10 feet below the gravel horizon in each soil boring. When the Data Gap Work Plan (MWH, 2013) was prepared, the depths of gravels were believed to be shallower, on the order of ±10 feet. However, during the test pitting, the depths of gravel were shown to be generally much deeper than 10 feet throughout the site, with the exception of the east-west trending shallow gravel area. The main purpose of the gravel sampling was to determine the hydraulic conductivity of the gravels for the purpose of sizing potential infiltration basins for treated groundwater. Given that the depth of excavation required to obtain the required amount of capping soil in general will be much shallower than the underlying gravels, it was determined that the controlling factor in the infiltration basins will be the in-situ hydraulic conductivity of the silts. Therefore, an undisturbed sample of the silts was collected at a deeper depth, 12-14 feet bgs, in SB0007 to provide data for this purpose. Further, the gravels that were contacted appeared to be very uniform in terms of shape and size suggesting that the hydraulic conductivity of these gravels will be fairly uniform. Therefore, no additional sampling is required at deeper depths for the gravels.

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## 2.2 STORMWATER SEWER SURVEY

### 2.2.1 Background and Objectives

Historical information gathered during the Supplemental Remedial Investigation (SRI) indicated that the subsurface stormwater piping located in RA-A had carried stormwater runoff and process materials from the furnace building and phos loading dock (RA-B) to the railroad swale (RA-K). These process materials consisted of wash waters that were suspected of containing ore, slag, precipitator slurry, and phossy water (containing elemental phosphorus). However, it was not known if these materials were still present in the underground stormwater piping and to what extent. The selected remedy (Soil Alternative 3) prescribed that the underground stormwater sewer piping within RA-A (to be capped with a gamma cap) be cleaned out to remove any process materials that could present a threat to groundwater or future site workers (i.e., elemental phosphorus, metals, and radionuclides). Underground storm sewer piping that is successfully cleaned in-place will no longer present a threat to human health and the environment as all COCs potentially associated with the storm sewer piping (i.e., P4, radionuclides, metals, and leachable metals posing a threat to groundwater) will have been removed and appropriately disposed. Therefore, cleaned underground storm sewer piping by itself meets all of the RAOs specified in the IRODA.

A video survey of the subsurface stormwater piping located in RA-A was conducted to determine the approximate volume of accumulated solids within the piping (with the potential presence of P4) and to estimate the amount of material (sediments) that will require removal, characterization, and disposal. The subsurface stormwater sewer piping included in the video survey is presented in Figure 2-2. Although the cleaning of the stormwater sewer piping as specified in the selected remedy was limited to the piping within RA-A, an attempt will be made to clean all of the stormwater sewer piping as shown in Figure 2-2 during the remedial action. If cleaning of any piping segment is not possible due to physical constraints, the ET cap over RA-B will be extended to cover the uncleaned segments. As stated in the IRODA, placement of a properly designed ET cap over underground piping would meet all of the above listed RAOs, even with the presumption that radionuclides, metals, and/or P4 remain within the un-cleaned sections of the underground storm sewer piping. Also, any stormwater piping which extends under an ET cap will be plugged with concrete to prevent water migration through the piping under the ET cap.

### 2.2.2 Video Survey Description

The stormwater sewer video survey was performed on November 6, 2013. The video surveillance utilized a remote control robotic camera that was lowered down into the piping through existing drain inlets, manholes and discharges. This technology is typically used on underground sewer piping that has been cleaned prior to the survey. Results of the video survey were very useful, but limited due to the inability of the robotic camera to proceed through 16-

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inch piping that was partially full of sediment and did not fit in the 8-inch lines. A DVD of the survey video is included in Appendix G. A summary of the video surveys is presented below with the surveyed piping segments shown on Figure 2-2:

- **The piping segment from west discharge pipe toward Area Inlet #4 -** This piping segment consists of a 16-inch concrete pipe from the west discharge into the railroad swale (RA-K) toward the Area Inlet #4 (about 129 feet total length). This segment was about 50% full of sediments at the discharge and there was not sufficient headspace to send the robotic camera into this piping. The sediment as observed from the end of the west discharge pipe appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment.
- **The piping segment from Area Inlet #4 toward the west discharge pipe –** This piping segment is the same as described above. An attempt was made to send the robotic camera in the reverse direction from Area Inlet #4 toward the west discharge pipe. The robotic camera was only able to travel about 2 feet before becoming stuck in the sediment. The sediment as observed from the robotic camera and from decon of the robotic camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment. This pipe as observed from Area Inlet #4 was greater than 50% full of sediments.
- **The piping segment from east discharge pipe toward Area Inlet #1 -** This piping segment consists of a 16-inch concrete pipe from the east discharge into the railroad swale (RA-K) toward the Area Inlet #1 (about 85 feet total length). This segment was surveyed with the robotic camera. The first half of the pipe was relatively clean from the east discharge until about 40 feet into the pipe. The pipe was about 10 to 20% full of sediment the remainder of the distance to Area Inlet #1. The sediment as observed from the robotic camera and from decon of the camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment.
- **The piping segment from Area Inlet #4 to Area Inlet #3 -** This piping segment consists of a 16-inch concrete pipe from the Area Inlet #4 to Area Inlet #3 (about 107 feet total length). An attempt was made to send the robotic camera from Area Inlet #4 toward Area Inlet #3. The robotic camera was not able to travel down this segment due to the sediment. The sediment as observed from the robotic camera and from the decontamination of the robotic camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment. This pipe as observed from Area Inlet #4 is assumed to be 100% full of sediments.
- **The piping segment from Area Inlet #4 to Area Inlet #2 and Area Inlet #5 -** These piping segments consists of 8-inch steel piping from the Area Inlet #4 to Area Inlet #2 (about 170 feet total length). A separate 8-inch steel pipe branches off from this segment toward Area Inlet #5 (about 180 feet total length). As the robotic camera could not pass through an 8-inch pipe, an attempt was made to send a cable camera from Area Inlet #4 toward Area Inlet #2 and Area Inlet #5. The cable camera was not able to travel down these piping segments due to the sediments in the pipes and access restrictions. The sediment as observed from the cable camera and from decon of the cable camera appeared to consist of ore, slag, rust, and native soils. There was no evidence of P4 in the

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sediment. These pipes as observed from Area Inlet #4 are assumed to be 70% full of sediments.

- **The piping segment from Manhole #1 to Area Inlet #3 -** This piping segment consists of a 16-inch concrete pipe from Manhole #1 to Area Inlet #3 (about 169 feet total length). The robotic camera was sent from Manhole #1 toward Area Inlet #3 and traveled about 55 feet before being blocked by sediment. The sediment as observed from the robotic camera and from decon of the robotic camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment. This pipe as observed from Manhole #1 is assumed to be 50% full of sediments.
- **The piping segment from Area Inlet #1 to Area Inlet #3 –** While historical plant drawings indicate that the piping segment from Area Inlet #1 to Area Inlet #3 exists, visual investigation of the vault at Area Inlet #1 did not reveal the presence of a pipe entering from the south – only a pipe running towards the north to the East Discharge. Similarly, visual investigation of the vault at Area Inlet #3 only revealed pipes connected on the south side (from Manhole #1) and west side (toward Area Inlet #4); no pipe leaving to the north towards Area Inlet #1 was present. Whether the historical drawing was incorrect or had not been updated to reflect later removal of the pipe segment cannot be determined; regardless, there is no observable evidence that a segment of piping is present between Area Inlet #3 and Area Inlet #1. Therefore, this segment was not present to survey.

### 2.2.3 Equipment Decon and Waste Determination

After each segment was surveyed (or attempted to be surveyed), the robotic camera or cable camera were decontaminated as removed from the piping. The cameras and cables were decontaminated using water and brushes to mechanically remove the contaminants. The decon water was collected in a plastic drum. The removed materials appeared to be primarily ore, slag, and native solids. There was no evidence of P4 (i.e., no observed smoking). The decon water and sediments were separated and sent to a laboratory for waste determination analysis. The results of the analyses are presented in Appendix G. Based upon observations, process knowledge, and the laboratory analyses, the decon water and sediments removed from the video equipment were determined to be non-hazardous and were managed pursuant to the Work Plan.

Findings and conclusions of the video survey are presented in Section 4.4.

## 2.3 VEGETATION TRIAL PLOT SAMPLING

In order to provide site-specific information associated with root depth and density, sampling was performed on FMC's former vegetation trial plots to provide an estimate of these parameters for use in performance modeling of the ET cover. Prior to laying out the sampling grid, test holes were excavated with a shovel to identify an area containing at least 18-inches of soil. Once identified, a 25 ft by 25 ft transect was measured. The transect was further divided into 5 ft by ft sampling grids. Three randomly placed hand-auger borings were advanced within each sampling grid and samples were collected at 6-inch increments (e.g. 0-6'', 6-12'', etc.). In general, top

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soil sampling was possible to a depth of 18-inches in the majority of soils with some locations only having top soil depth to 12-inches before contacting the underlying slag. The vegetation sampling grid is shown in Figure 2-3.

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# 3.0 Laboratory Testing and Results

Following sample collection, the soil samples from the WUA, vegetation trial plot samples, and stormwater sewer piping were sent off for laboratory testing and analysis as described below.

## 3.1 WESTERN UNDEVELOPED AREA SOIL TESTING

### 3.1.1 Geotechnical Testing

Following collection of the disturbed (composite) and undisturbed samples, the samples were sent to IGES out of Salt Lake City for geotechnical and hydrological testing. The following tests were performed to further define the geotechnical properties of the soil:

Disturbed (composite) samples from test pits:

- Atterberg Limits (American Society of Test and Materials [ASTM] D4318) testing was conducted to evaluate the shrink-swell potential of the soil and its propensity to develop desiccation cracks during cyclical wetting and drying.
- Standard Proctor (ASTM D698) testing was conducted to further refine the maximum dry density (MDD) and optimum moisture content (OMC) of the soil to be used for specifying the percent compaction and in-place density of the soil.
- Particle size distribution testing (ASTM D422) was conducted to provide an indicator of material properties across the entire borrow area.
- Crumb and double hydrometer dispersion testing (ASTM D6572-12 and ASTM D4221-11) were conducted to evaluate the erosive potential of the soil due to dispersion.

Undisturbed samples from borings:

- In-situ density (ASTM D7263-09)
- In-situ moisture content (ASTM D2216-10)

The geotechnical tests and associated results performed on the grab samples collected from each test pit are summarized in Table 3.1. The laboratory report for the geotechnical tests are presented in Appendix D.

### 3.1.2 Hydrological Testing

The following tests were performed to determine the saturated and unsaturated hydrological properties of the borrow soil based on test pit samples and two boring samples (SB007 at 6’ to 8’ and 12’ to 14’ bgs):

- Saturated Hydraulic Conductivity (ASTM D5084)
- Water Characteristic Curve Testing (ASTM D6836)

The hydrological tests performed on the grab samples collected from each test pit and associated results are summarized in Table 3.2. The laboratory reports for the hydraulic tests are presented in Appendix D.

## Table 3.1 Summary of WUA Soil Geotechnical Testing and Associated Results

| Soil Test | TP001 | TP002 | TP003 | TP004 | TP005 | TP006 | TP007 | TP008 | TP009 | TP010 | SB003 | SB004 | SB006 | SB007 | SB008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard Proctor Compaction Test (MDD lbs/ft$^3$) (ASTM[a/] D698) | 106.9 | 97.7 | 107 | 106.4 | 107.2 | 104.4 | 104.2 | 99.6 | 103.7 | 104.8 | NA[b/] | NA | NA | NA | NA |
| Optimum Moisture Content (OMC %) (ASTM D698) | 17.5 | 22.7 | 16.6 | 16.2 | 15.9 | 16.8 | 17.7 | 19.4 | 16.9 | 16.8 | NA | NA | NA | NA | NA |
| Particle Size Distribution (ASTM D422) | | | | | | | | | | | NA | NA | NA | NA | NA |
| % Gravel | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 – 0.1 | 0.0 | 0.6 | 0.1 | | | | | |
| % Sand | 3.4 - 4.8 | 1.6 – 9.4 | 4.1 – 4.8 | 2.9 – 4.5 | 3.3 – 3.7 | 4.0 – 4.4 | 12.4 – 15.4 | 4.1 – 11.4 | 3.7 – 5.5 | 6.5 – 7.4 | | | | | |
| % Fines | 95.2 – 96.6 | 90.6 – 98.4 | 95.0 – 95.6 | 95.5 – 97.1 | 96.3 – 96.7 | 95.6 - 96 | 84.6 – 87.6 | 88.6 – 95.9 | 94.0 – 95.8 | 92.5 – 93.4 | | | | | |
| Atterberg Limits (ASTM D4318) | | | | | | | | | | | NA | NA | NA | NA | NA |
| LL[c/] (%) | 28 | 36 | 27 | N.P.[f/] | 24 | 25 | 23 | 28 | 26 | N.P. | | | | | |
| PL[d/] (%) | 21 | 22 | 21 | | 22 | 21 | 22 | 22 | 21 | | | | | | |
| PI[e/] (%) | 7 | 14 | 6 | | 2 | 4 | 1 | 6 | 5 | | | | | | |
| Crumb Test (D6572-12) | 2[g/] | 2 | 3 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | NA | NA | NA | NA | NA |
| Double Hydrometer Dispersion Test (D4221-11) (% Dispersion) | 22.5 | 24.8 | 44.3 | 33.9 | 32.1 | 38.0 | 37.4 | 18.6 | 29.7 | 24.4 | NA | NA | NA | NA | NA |
| In situ Density (lbs/ft$^3$) (ASTM D7263-09) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 90.8 (0' to 2') | 77.5 (2' to 4')<br>78.1 (6' to 8') | 80.2 (2' to 4')<br>81.7 (6' to 8') | 70.4 (2' to 4')<br>94.7 (6' to 8')<br>85.3 (12' to 14') | 79.3 (2' to 4')<br>77.3 (6' to 8') |
| In-situ Moisture Content (%) (ASTM D2216-10) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 4.9 (0' to 2') | 4.8 (2' to 4')<br>6.0 (6' to 8') | 15.1 (2' to 4')<br>9.4 (6' to 8') | 15.5 (2' to 4')<br>5.9 (6' to 8')<br>3.3 (12' to 14') | 8.4 (2' to 4')<br>8.6 (6' to 8') |

Notes:
[a/] ASTM American Society of Testing and Materials
[b/] Not Analyzed
[c/] LL: Liquid Limit
[d/] PL Plastic Limit
[e/] PI: Plasticity Index
[f/] NP: Non-plastic

## Table 3.2 Summary of WUA Soil Hydrological Testing and Associated Results

| Test Pit/Boring I.D. | $K_{sat}$[b/] (cm/sec) | Van Genuchten Parameters[a/] | | | |
|---|---|---|---|---|---|
| | | $\alpha$[c/] ($cm^{-1}$) | N[d/] (dimensionless) | $\theta_r$[e/] (% vol) | $\theta_s$[f/] (% vol) |
| TP001 | 3.3E-05 | 1.0624 | 1.2659 | 0.0207 | 0.5257 |
| TP004 | 1.4E-04 | 1.7409 | 0.2293 | 0.0431 | 0.4417 |
| TP006 | 2.3E-05 | 0.5592 | 1.3116 | 0.0191 | 0.4776 |
| TP007 | 5.8 E-05 | 0.8571 | 1.3562 | 0.0409 | 0.4865 |
| TP008 | 7.87E-05 | 0.6665 | 1.4267 | 0.0543 | 0.5219 |
| SB03 (2-15 feet) | 2.6E-06 | NA[f/] | NA[f/] | NA[f/] | NA[f/] |
| SB7 (6 to 8 feet bgs) | 6.2E-05 | NA[f/] | NA[f/] | NA[f/] | NA[f/] |
| SB7 (12 to 14 feet bgs) | 3.1E-04 | NA[f/] | NA[f/] | NA[f/] | NA[f/] |

**Notes:**

[a/] Van Genuchten Parameters for SWCC testing (ASTM 6836)
[b/] $K_{sat}$ = saturated hydraulic conductivity (ASTM D5084)
[c/] $\alpha$ = inverse of the air-entry value (or bubbling pressure)
[d/] n = pore size distribution index [dimensionless]
[e/] $\theta_r$ = residual water content
[f/] $\theta_s$ = saturated water content
[g/] NA = not analyzed

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The DGWP specified that Soil Water Characteristic Curve Testing would be performed on disturbed samples remolded to both 85 and 90% of MDD. However, Water Characteristic Curve Testing was performed only on disturbed samples remolded to 85% MDD. The deviation was mainly due to the fact that the construction specifications for the cover soil (silt from the WUA) would target an in-place density of 85% MDD ±3%. This specification has been chosen to limit the in-place density to below 90% MDD. Therefore, Water Characteristic Curve Testing at 90% MDD was not warranted.

### 3.1.3 Agronomic Testing

Three (3) composite samples (CP01, CP02 and CP03), derived from the ten (10) test pits were sent off for agronomic testing. The agronomic testing was performed by ACZ Laboratories. The agronomic test performed and associated results are presented in Table 3.3. As indicated by Table 3.3, the results were consistent for the three samples. The laboratory reports for the agronomic testing are presented in Appendix E.

**Table 3.3 Summary of WUA Soil Agronomic Testing and Associated Results**

| Analyses | Sample I.D. | | |
|---|---|---|---|
| | WUA-CP01 | WUA-CP02 | WUA-CP03 |
| Cation Exchange Capacity (meq/100g) | 8.50 | 11.0 | 10.0 |
| Phosphorus, total (mg/Kg) | 790 | 780 | 790 |
| Potassium, total (mg/Kg) | 2410 | 2780 | 2620 |
| Carbon, total organic (%) | 0.2 | 0.2 | 0.2 |
| Conductivity @25°C (mmhos/cm) | 0.442 | 0.594 | 0.456 |
| Organic Matter (%) | 0.8 | 0.9 | 0.9 |
| pH, Saturated Paste | 8.6 | 8.4 | 8.5 |
| Solids (%) | 94.1 | 91.9 | 93.0 |
| Nitrogen, ammonia (mg/Kg) | 10.6 | 11.1 | 10.7 |

## 3.2 ROOT DENSITY TESTING

Root density testing was performed using the procedures described in the Work Plan. The results of the root density testing are summarized in Table 3.4. The laboratory report for the root density measurements are presented in Appendix F.

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## Table 3.4 Root Density Measurements

| Sample | Grams of Roots per 100 grams of Soil |
|---|---|
| **Grid #6—Location #1** | |
| 0-6 inches | 0.019 |
| 6-12 inches | 0.078 |
| 12-18 inches | 0.003 |
| **Grid #6—Location #2** | |
| 0-6 inches | 0.084 |
| 6-12 inches | 0.019 |
| 12-18 inches | 0.014 |
| **Grid #6—Location #3** | |
| 0-6 inches | 0.032 |
| 6-12 inches | 0.013 |
| 12-18 inches | 0.005 |
| **Grid #7—Location #1** | |
| 0-6 inches | 0.039 |
| 6-12 inches | 0.020 |
| 12-18 inches | 0.013 |
| **Grid #7—Location #2** | |
| 0-6 inches | 0.036 |
| 6-12 inches | 0.029 |
| 12-18 inches | 0.021 |
| **Grid #7—Location #3** | |
| 0-6 inches | 0.089 |
| 6-12 inches | 0.024 |
| 12-18 inches | 0.015 |
| **Grid #8—Location #1** | |
| 0-6 inches | 0.102 |
| 6-12 inches | No sample |
| 12-18 inches | 0.020 |
| 18-24 inches | 0.006 |
| **Grid #8—Location #2** | |
| 0-6 inches | 0.076 |
| 6-12 inches | 0.075 |
| 12-18 inches | 0.013 |
| 18-24 inches | 0.004 |
| **Grid #8—Location #3** | |
| 0-6 inches | 0.048 |
| 6-12 inches | 0.028 |
| 12-18 inches | 0.013 |
| **Grid #13—Location #1** | |
| 0-6 inches | 0.104 |
| 6-12 inches | 0.036 |
| 12-18 inches | No sample |
| **Grid #13—Location #2** | |
| 0-6 inches | 0.064 |
| 6-12 inches | 0.032 |
| 12-18 inches | No sample |
| **Grid #13—Location #3** | |
| 0-6 inches | 0.101 |
| 6-12 inches | 0.034 |
| 12-18 inches | 0.014 |
| **Grid #14—Location #1** | |
| 0-6 inches | 0.087 |
| 6-12 inches | 0.054 |
| 12-18 inches | 0.016 |

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| Sample | Grams of Roots per 100 grams of Soil |
|---|---|
| **Grid #14—Location #2** | |
| 0-6 inches | 0.109 |
| 6-12 inches | 0.051 |
| 12-18 inches | 0.026 |
| **Grid #14—Location #3** | |
| 0-6 inches | 0.053 |
| 6-12 inches | 0.040 |
| 12-18 inches | 0.019 |
| **Grid #15—Location #1** | |
| 0-6 inches | 0.054 |
| 6-12 inches | 0.018 |
| 12-18 inches | 0.011 |
| **Grid #15—Location #2** | |
| 0-6 inches | 0.077 |
| 6-12 inches | 0.038 |
| 12-18 inches | 0.008 |
| **Grid #15—Location #3** | |
| 0-6 inches | 0.060 |
| 6-12 inches | 0.023 |
| 12-18 inches | 0.013 |
| **Grid #16—Location #1** | |
| 0-6 inches | 0.069 |
| 6-12 inches | 0.051 |
| 12-18 inches | 0.016 |
| **Grid #16—Location #2** | |
| 0-6 inches | 0.118 |
| 6-12 inches | 0.044 |
| 12-18 inches | 0.023 |
| **Grid #16—Location #3** | |
| 0-6 inches | 0.083 |
| 6-12 inches | 0.030 |
| 12-18 inches | 0.016 |
| Grid #17—Location #1 | |
| 0-6 inches | 0.093 |
| 6-12 inches | 0.024 |
| 12-18 inches | 0.013 |
| 18-24 inches | 0.005 |
| **Grid #17—Location #2** | |
| 0-6 inches | 0.052 |
| 6-12 inches | 0.020 |
| 12-18 inches | 0.015 |
| 18-24 inches | 0.002 |
| **Grid #17—Location #3** | |
| 0-6 inches | 0.037 |
| 6-12 inches | 0.031 |
| 12-18 inches | 0.015 |
| 18-24 inches | 0.006 |
| **Grid #18—Location #1** | |
| 0-6 inches | 0.014 |
| 6-12 inches | 0.018 |
| 12-18 inches | 0.003 |
| **Grid #18—Location #2** | |
| 0-6 inches | 0.068 |
| 6-12 inches | 0.023 |
| 12-18 inches | 0.013 |
| **Grid #18—Location #3** | |

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| Sample | Grams of Roots per 100 grams of Soil |
|---|---|
| 0-6 inches | 0.041 |
| 6-12 inches | 0.022 |
| 12-18 inches | 0.011 |

As indicted in Table 3.4, 3 discrete interval samples were not analyzed. The two Grid # 13 samples collected at an interval of 12- 18-inches were not sent to the lab due to the presence of shallow slag, which precluded obtaining a hand-auger sample. The sample associated with Grid #8 for the 6 to 12 inch interval was not analyzed because the quart size bag sample bag was reported as torn when received at the laboratory and was evidently damaged during shipment. All other samples were inspected upon arrival and determined to be intact.

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# 4.0 Data Gap Findings and Conclusions

This section presents recommendations for the design parameters to be used in the Remedial Design (RD). ProUCL 5.0 Statistical Software was used to calculate the means for the design parameters shown in the table below. The results of the ProUCL analysis are presented in Appendix H. As shown in Appendix H, the data for the geotechnical and hydrological parameters were generally normally distributed and hence the use of mean values for these parameters in the remedial design is appropriate.

## 4.1 GEOTECHNICAL RECOMMENDATIONS

The main purpose of the geotechnical testing was to define appropriate design parameters of the WUA borrow soil for use in ET soil cover modeling, to estimate volume of soil required from the WUA, and evaluate the WUA soils susceptibility to erosion and desiccation cracking. The proposed geotechnical design parameters for the WUA borrow soil are summarized Table 4.1.

**Table 4.1 Recommended Geotechnical Design Parameters for WUA Borrow Soil**

| Parameter | Value |
|---|---|
| MDD (lbs/ft$^3$) per ASTM D698 | 104.2 (mean) |
| OMC (%) per ASTM D698 | 17.1 (mean) |
| In situ Density (lbs/ft3) per ASTM D7263-09 | 81.1 (mean) |
| In-situ Moisture Content (%) per ASTM D2216-10 | 8.7 (mean) |

A review of particle size distribution curves and Atterberg Limits, which are known to be key soil index properties, suggest that the silts within the WUA are very uniform. Although disturbed grab samples were not collected at depths deeper than 10 feet, visual observations of the silts below 10 feet in test pits and soil borings indicate that the soils are uniform in terms of soil color, texture, plasticity, and gran size. Therefore, the physical properties of the silts at deeper depths are adequately represented by the grab samples collected to a depth of 10 feet.

Atterberg limits and dispersive testing was performed on the majority of disturbed samples to assess the potential for desiccation cracking and erosion of the silts. Based on the Atterberg limits testing, the plasticity index (PI), ranged between 1 and 14. These results indicate that the soils have very low-plasticity and therefore are not susceptible to desiccation cracking associated with volumetric changes (shrinkage) induced by moisture fluctuations. The results of the dispersion testing both (Crumb and double hydrometer testing) indicate that the soils are generally non-dispersive to moderately dispersive based on Crumb test results characterizing the

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majority of samples being between a Grade 1(non-dispersive) and 2 (intermediate) and double hydrometer testing ranging between 18.6 and 44.3 percent dispersion. Therefore, based on these results, there is nothing to preclude the WUA soils being used as capping soil.

## 4.2 HYDROLOGICAL RECOMMENDATIONS

The main purpose of the hydrological testing was to define appropriate design parameters of the WUA borrow soil for use in the modeling of the ET soil cover. The proposed hydrological design parameters for the WUA borrow soil are summarized Table 4.2.

**Table 4.2 Recommended Hydrological Design Parameters for WUA Borrow Soil**

| Parameter | Value |
|---|---|
| Hydraulic Conductivity (cm/sec) per ASTM 5084 | 6.57E-5 (mean) |
| **Van Genuchten Parameters (per ASTM 6836)** | |
| $\alpha$ (cm) | 0.97722 (mean) |
| n (dimensionless) | 1.11794 (mean) |
| $\theta_r$ (%vol) | 0.03562 (mean) |
| $\theta_s$ (%vol) | 0.49068 (mean) |

## 4.3 ROOT DENSITY RECOMMENDATIONS

The main purpose of the root density testing was to provide a quantification of the vegetation quality that can be established for use in the ET soil cover modeling. Based on the ProUCL analysis presented in Appendix H, a mean was selected resulting in a design root density value of 0.051 grams of roots per 100 grams of soil.

## 4.4 STORMWATER SEWER VIDEO SURVEY FINDINGS

A summary of the stormwater sewer piping video survey is provided in Table 4.3 presenting the total volume of solids expected to be removed, characterized, and disposed as result of the RA-A stormwater sewer pipe cleaning. While the video survey did not identify any P4 present in the stormwater sewer piping, all precautions will be taken during cleaning of the piping in the event P4 is encountered. Also, while the waste determination performed on the decon water and sediments collected during the video survey indicated that the water and sediments were non-hazardous, wastes generated during the cleaning of the stormwater sewer piping will be fully characterized.

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## 4.5 BORROW SOURCE AVAILABILITY

In addition to collecting disturbed and undisturbed soil samples, the WUA soil investigation was also used to characterize the approximate quantity of borrow soil available for use during the remedial action. The depth information obtained from the soil boring and test pit were used to develop an isocontour map of the depth of silt throughout the WUA and is presented in Figure 4-1. Based on Figure 4-1, there is approximately 2.4 million CY of soil (silt) available for use in the ET and Gamma soil covers. The preliminary required soil volume based on a 12-inch gamma cap and 30-inch ET cover is approximately 1.3 million CY. Therefore, there is ample soil available in the WUA to support the RA.

## Table 4.3 Summary of Stormwater Sewer Piping Video Survey

| Piping Segment | Total Segment Length (ft) | Pipe Construction | Pipe OD/ID (in) | Total Segment Volume ($ft^3$) | Percent Full of Sediment % | Maximum Sediment Volume to be Removed per Segment [1] ($ft^3$) | Evidence of P4? |
|---|---|---|---|---|---|---|---|
| West Discharge to Area Inlet #1 | 129 | concrete | 16/11.5 | 93 | 70 | 65 | No |
| East Discharge to Area Inlet #1 | 85 | concrete | 16/11.5 | 61 | 10 | 6 | No |
| Area Inlet #4 to Area Inlet #3 | 107 | concrete | 16/11.5 | 77 | 100 | 77 | No |
| Area Inlet #4 to Area Inlet #2 | 170 | steel | 8/7.98 | 60 | 70 | 42 | No |
| Area Inlet #5 to pipe junction | 180 | steel | 8/7.98 | 62 | 70 | 43 | No |
| Manhole #1 to Area Inlet #3 | 169 | concrete | 16/11.5 | 122 | 50 | 61 | No |
| **Total Maximum Sediment to be Removed** | | | | | | **294** | |

[1] This "maximum" sediment volume is a conservative estimate for waste management planning purposes.

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# 5.0 REFERENCES

EPA, 2012. Interim Amendment to the Record of Decision for the EMF Superfund Site - FMC Operable Unit - Pocatello, Idaho (IRODA), September 27, 2012.

EPA, 2013. Unilateral Administrative Order for Remedial Design and Remedial Action, EPA Docket No. CERCLA-10-2013-0116 (UAO for RDRA), June 10, 2013.

MWH, 2010. Supplemental Feasibility Study Report for the FMC Plant OU, MWH Americas, Inc., July 2010.

MWH, 2013a. Remedial Design Work Plan, MWH Americas, Inc., August 2013.

MWH, 2013b. Remedial Design Data Gap Work Plan, MWH Americas, Inc., October 2013.

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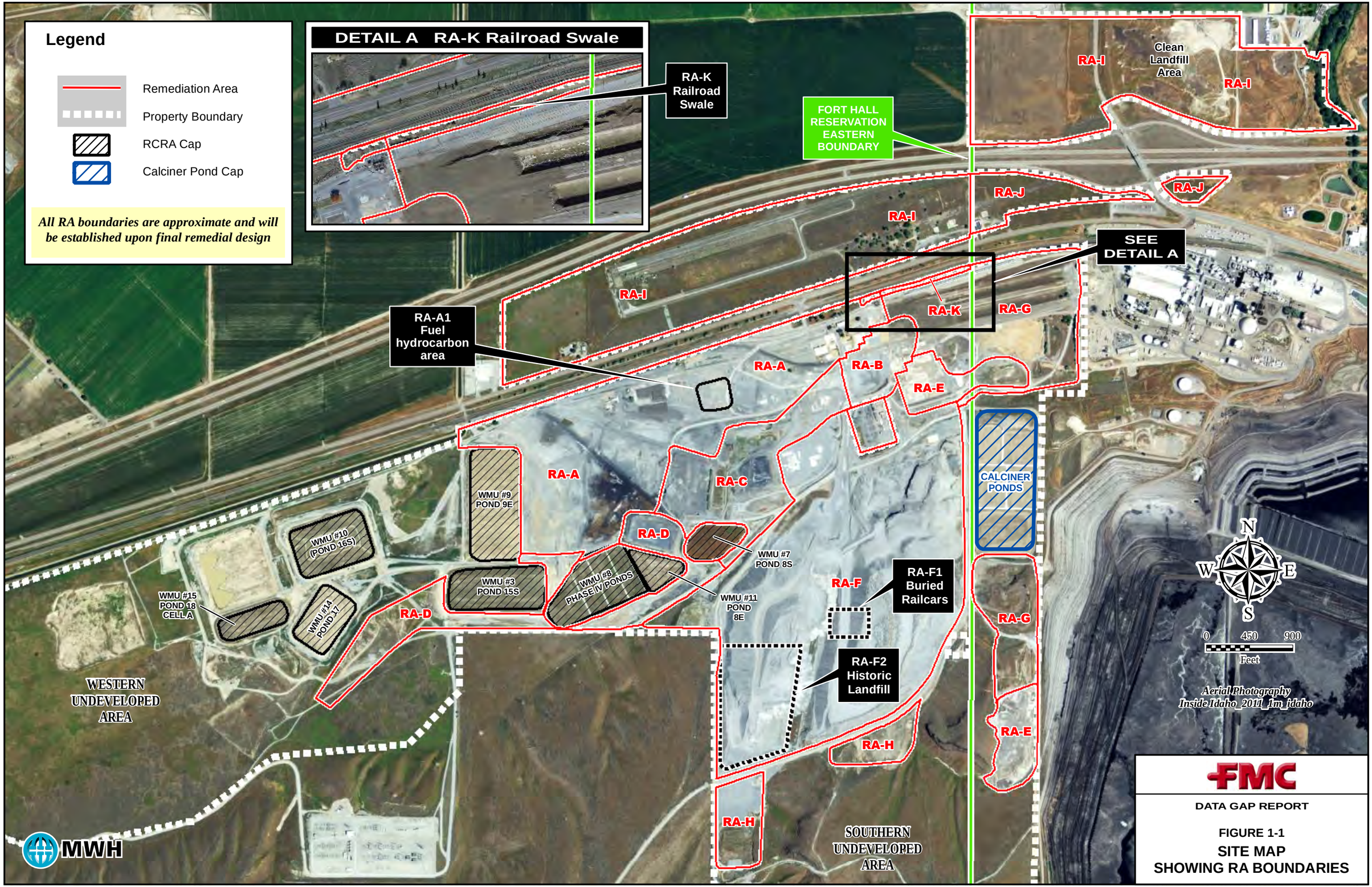
# Figures


Legend
Remediation Area
Property Boundary
RCRA Cap
Calciner Pond Cap
All RA boundaries are approximate and will be established upon final remedial design
DETAIL A RA-K Railroad Swale
RA-K Railroad Swale
FORT HALL RESERVATION EASTERN BOUNDARY
Clean Landfill Area
RA-I
RA-J
SEE DETAIL A
RA-K
RA-G
RA-A1 Fuel hydrocarbon area
RA-A
RA-B
RA-E
RA-C
RA-D
RA-F
RA-H
CALCINER PONDS
WMU #9 POND 9E
WMU #10 (POND 16S)
WMU #3 POND 15S
WMU #8 PHASE IV PONDS
WMU #7 POND 8S
WMU #11 POND 8E
WMU #15 POND 18 CELL A
WMU #14 POND 17
RA-F1 Buried Railcars
RA-F2 Historic Landfill
WESTERN UNDEVELOPED AREA
SOUTHERN UNDEVELOPED AREA
N
S
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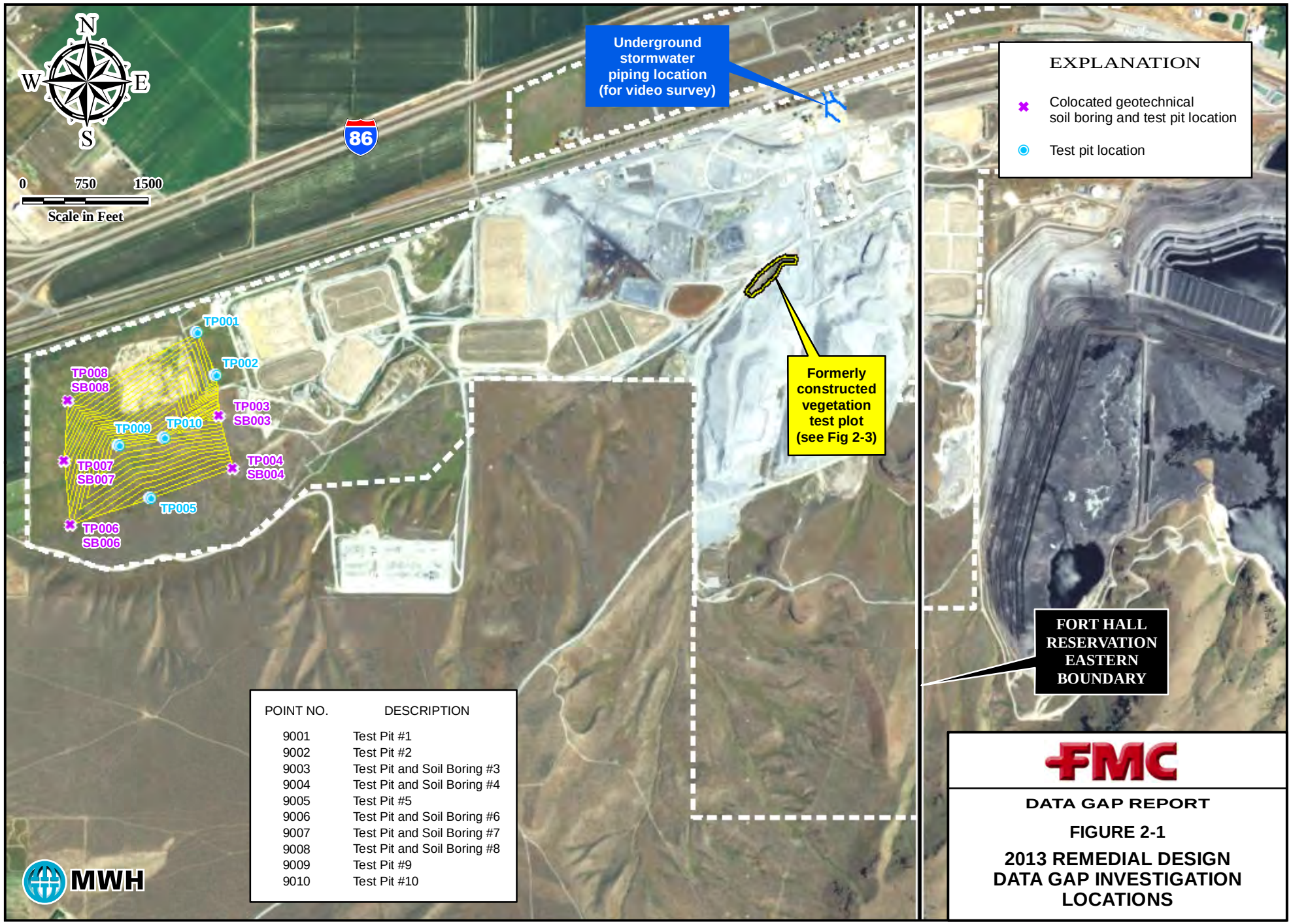
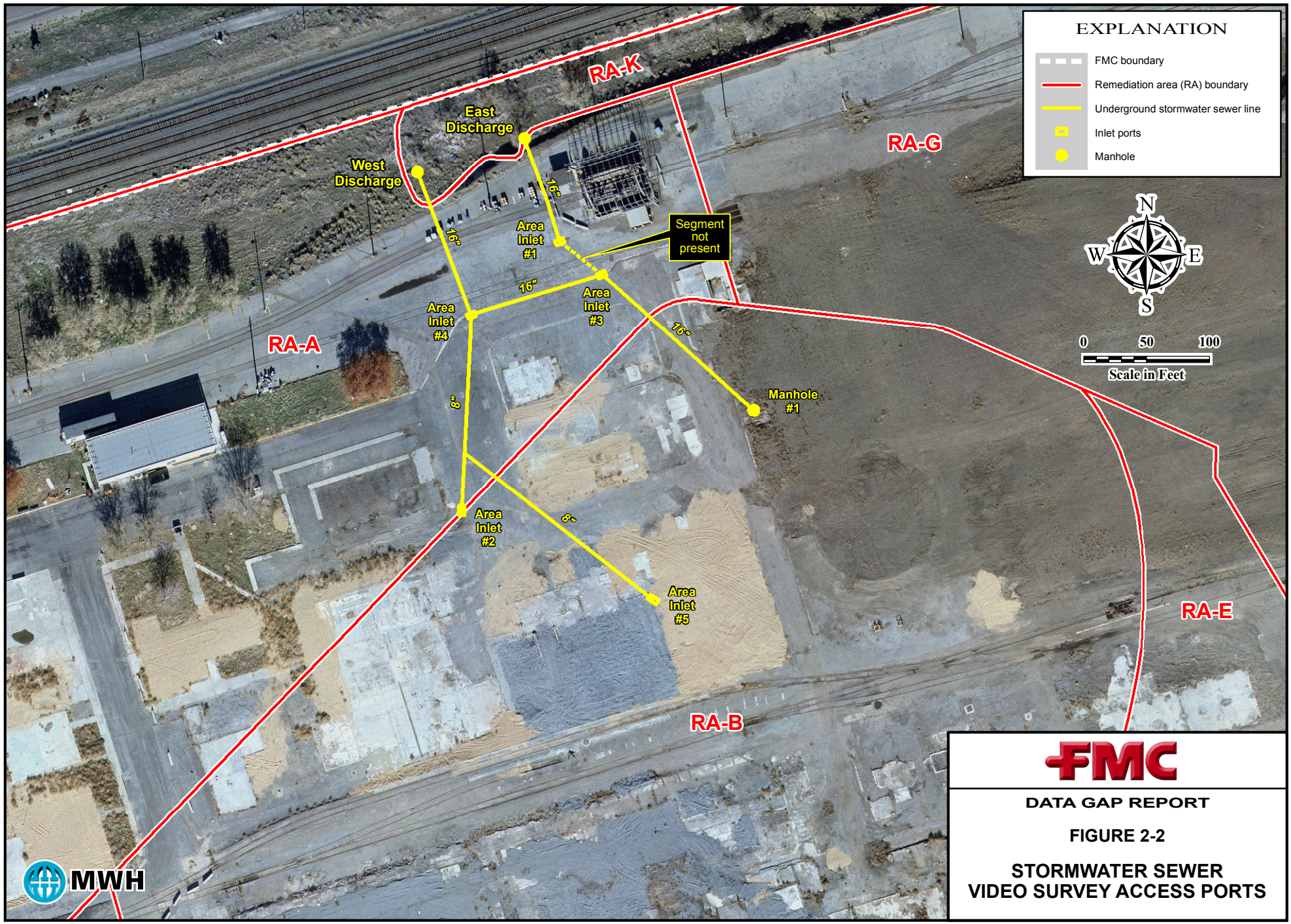
0 450 900
Feet
Aerial Photography Inside Idaho_2011_1m_idaho
MWH
FMC
DATA GAP REPORT
FIGURE 1-1
SITE MAP SHOWING RA BOUNDARIES
DATE: 27 Jan 2013
FILE: I:\projects\FMCIdaho\FMC_DATA GAP REPORT\FIGURES\Fig 1-1_FMC_Site Map showing RA Boundaries_Dec2013.mxd

FILE: I:\projects\FMCidaho\FMC_DATA GAP REPORT\FIGURES\Fig 2-1_2013 RD Data Gap Invest Locs.mxd DATE: 27 Jan 2014

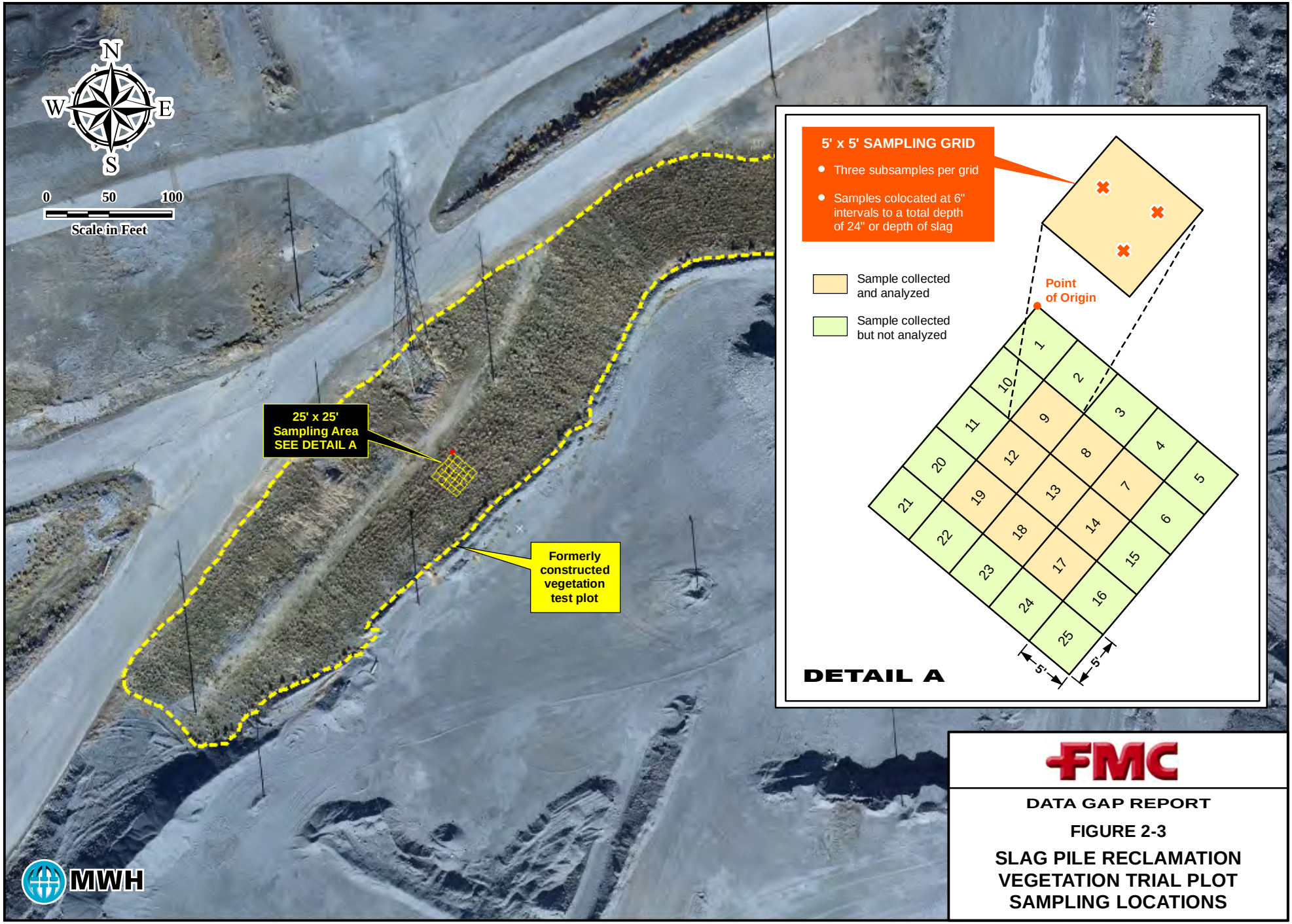



| POINT NO. | DESCRIPTION |
|---|---|
| 9001 | Test Pit #1 |
| 9002 | Test Pit #2 |
| 9003 | Test Pit and Soil Boring #3 |
| 9004 | Test Pit and Soil Boring #4 |
| 9005 | Test Pit #5 |
| 9006 | Test Pit and Soil Boring #6 |
| 9007 | Test Pit and Soil Boring #7 |
| 9008 | Test Pit and Soil Boring #8 |
| 9009 | Test Pit #9 |
| 9010 | Test Pit #10 |

FILE: I:\projects\FMCidaho\FMC_DATA GAP REPORT\FIGURES\Fig 2-2_Stormwater Video Survey_Mar2014.mxd DATE: 13 Mar 2014



FILE: I:\projects\FMCidaho\FMC_DATA GAP REPORT\FIGURES\Fig 2-3_Slag Pile Reclamation Veg Trial Plot.mxd DATE: 27 Jan 2014



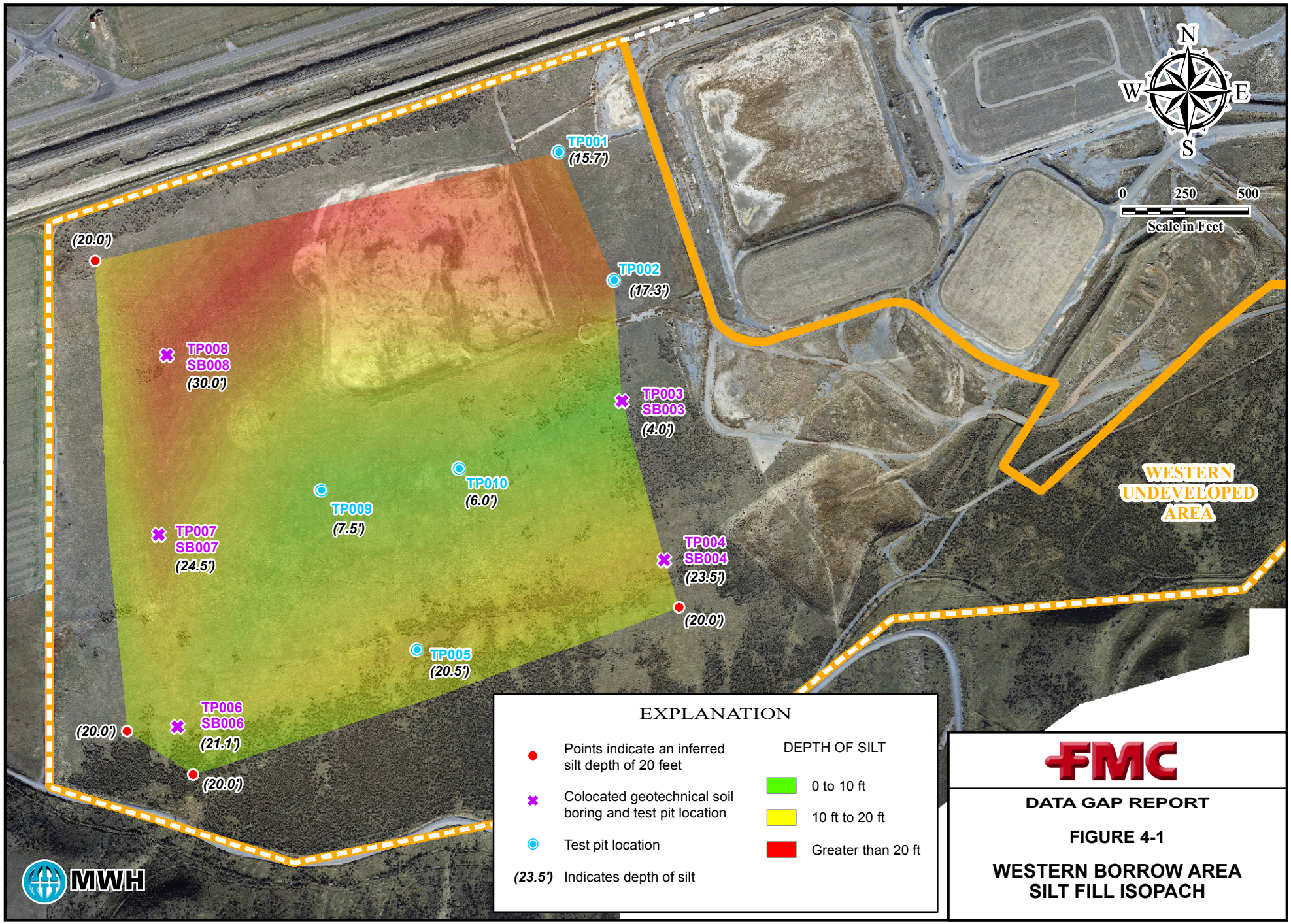

FMC

DATA GAP REPORT

FIGURE 2-3

SLAG PILE RECLAMATION VEGETATION TRIAL PLOT SAMPLING LOCATIONS

FILE: I:\projects\FMCidaho\FMC_DATA GAP REPORT\FIGURES\Fig 4-1_Western Borrow Area Silt Fill Isopach_Mar2014.mxd DATE: 14 Mar 2014



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# APPENDIX A

## Field Investigation Photographs

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**Photograph 1 (taken 10/29/2013) – Looking at base of excavation in TP001.**

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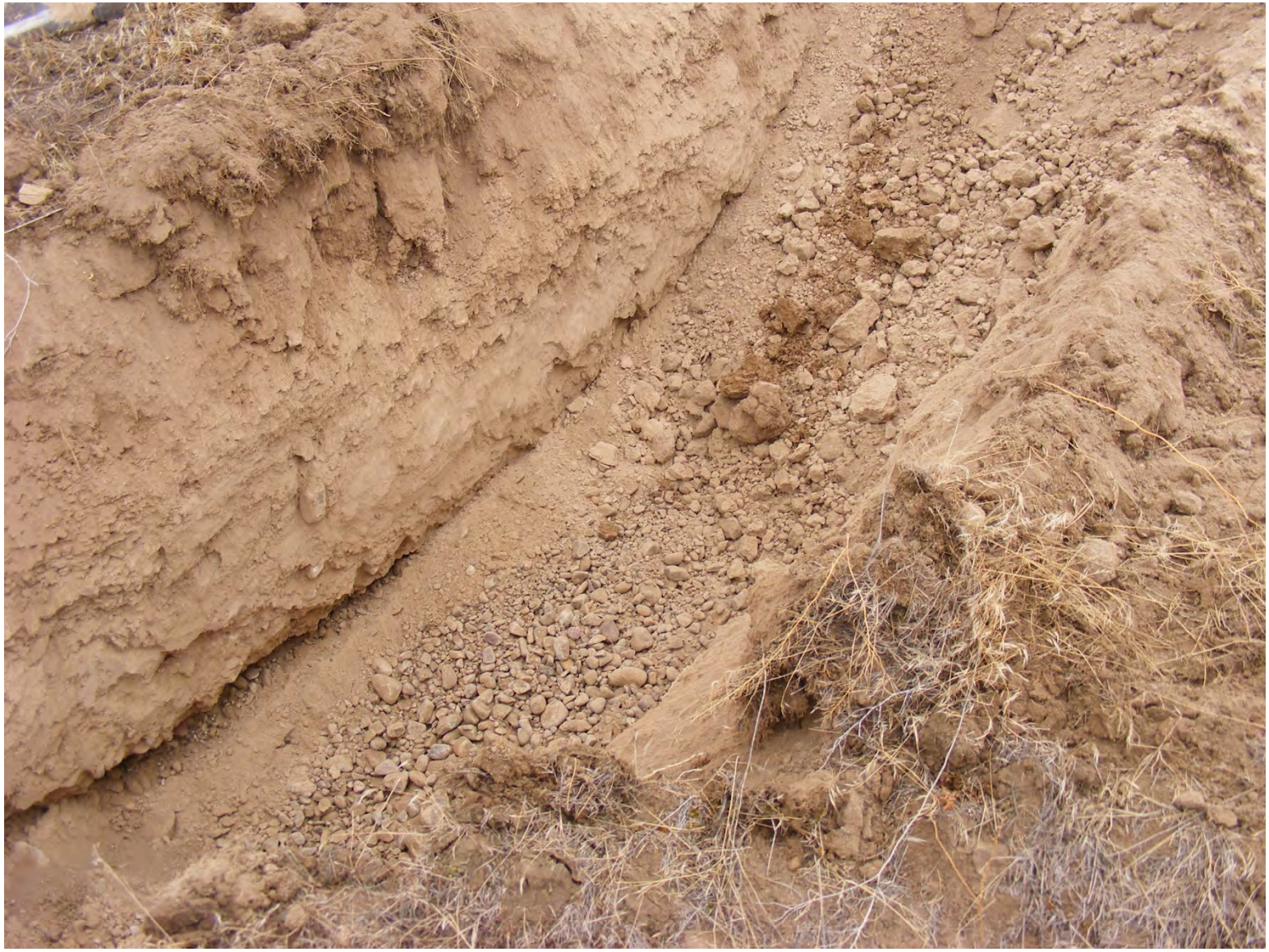

**Photograph 2 (taken 10/29/2013) – Looking at shallow gravels contacted in TP003 .**

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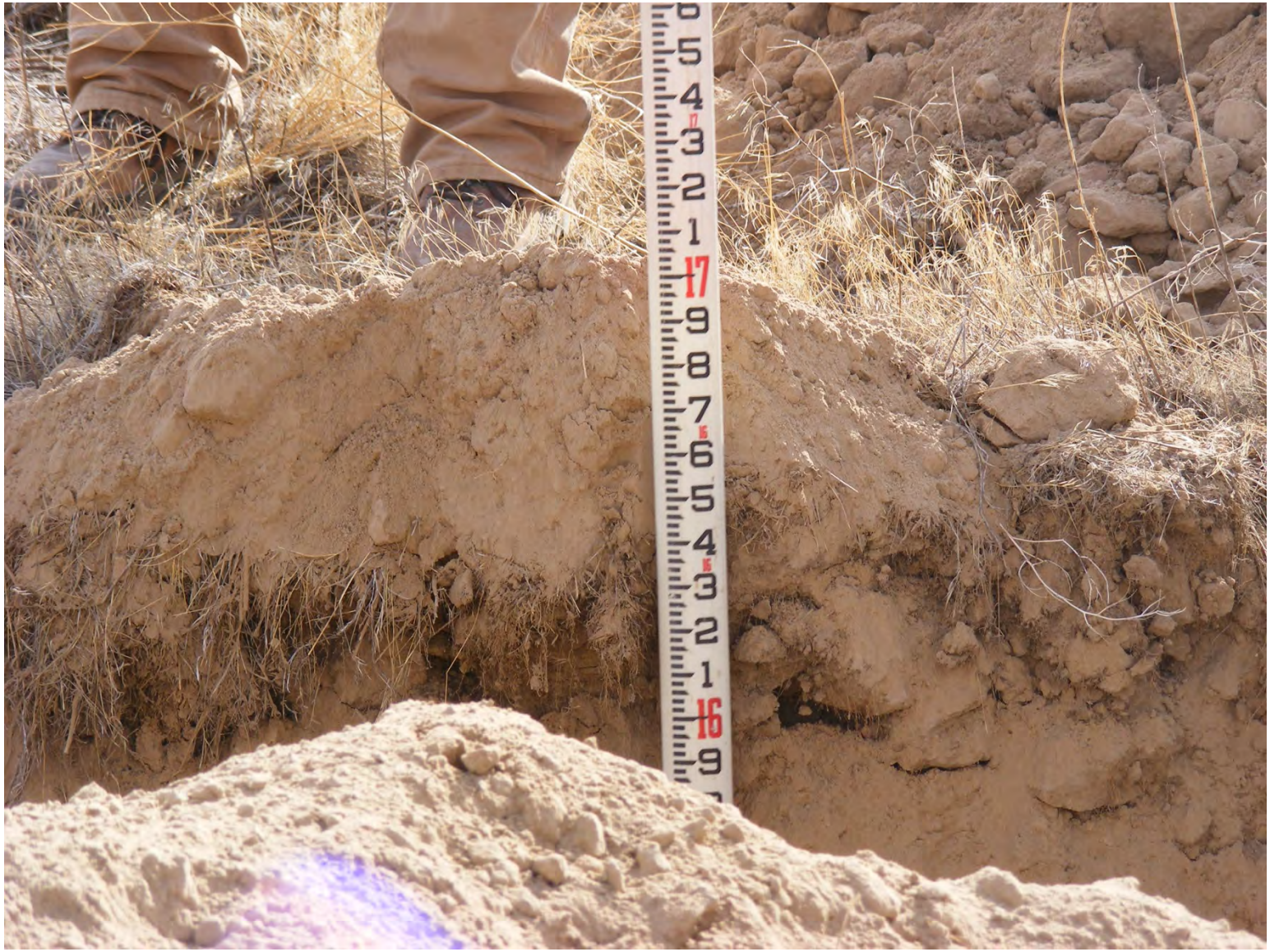

**Photograph 3 (taken 10/29/2013) – Looking at depth measurement taken at the base of TP004.**

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**Photograph 4 (taken 10/30/2103) – Looking at base of excavation in TP005.**

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**Photograph 5 (taken 10/30/2013) – 6-inch minus gravels excavated from TP009 encountered at 7.5 feet bgs.**

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**Photograph 6 (taken 11/12/2013) – Core taken from SB004 showing silt borrow material collected from 20 to 21.5 feet bgs.**

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**Photograph 7 (taken 11/12/2013) – Core taken from SB004 showing gravels collected from 25 to 26.5 feet bgs.**

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**Photograph 8 (taken 11/13/2013) – Looking southwest at hollow-stem auger drill rig at SB008.**

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**Photograph 9 (taken 11/06/2013) – Looking south at video survey equipment in 16-inch reinforced concrete pipe in entrance to East Discharge.**

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**Photograph 10 (taken 11/06/2013) – Video survey equipment lowered into manhole.**

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**Photograph 11 (taken 11/06/2013) – Video survey control room.**

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**Photograph 12 (taken 11/06/2013) – Decontamination of video survey equipment.**

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# APPENDIX B

## Test Pit Logs

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

# TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation  Project Number 10503311

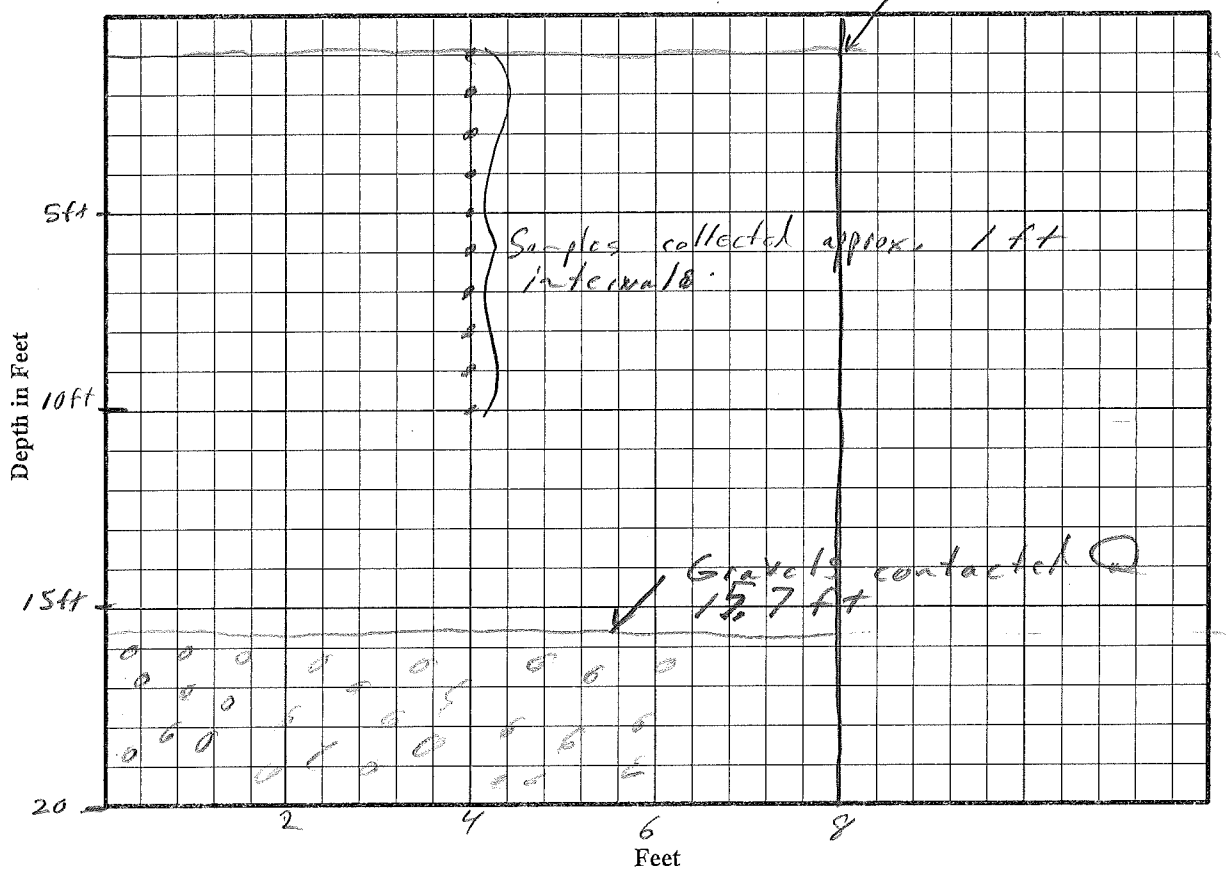
Sample Location WVA  Trench Number TP001  Date 10/29/2013

Coordinates: ~~Inside Stake~~ Northing 442820.8 N  ~~Outside Stake~~ Easting 548752.9 S

Elevation ~~Native/Fill Stake~~ 4441 ft amsl

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

12" Top soil with extensive roots

14.7' of silt, (ML), (Brown), (Low plasticity), moderat density, dry

15.7" gravel contacted, Gravel appeared to be quartzitic in nature. Mainly 4" minus.

Begin Trench 9:50  Finish Trench 10:25  Trenching Contractor KW

Total Depth 15.7 ft  Total Length 8 ft

MWH

FILE: Fig__ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

# TRENCH TEST PIT LOG FORM



Project FMC Data Gap Investigation Project Number 10503311

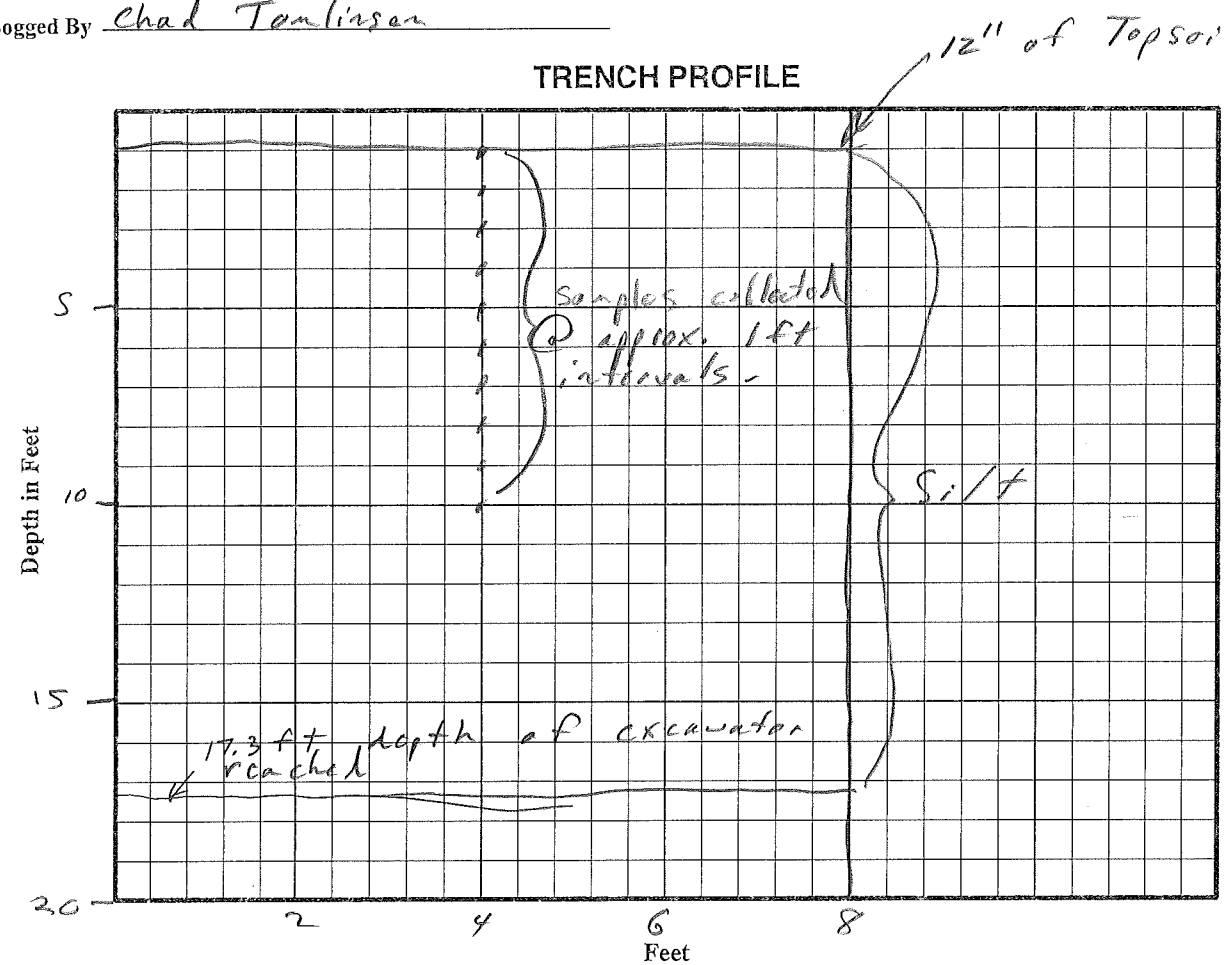
Sample Location WVA Trench Number TP002 Date 10/29/2013

Coordinates: ~~Inside Stake~~ Northing 449308.2 ~~Outside Stake~~ Easting 548972.9

Elevation ~~Native/Fill Stake~~ 4441.8

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Excavated to total depth of 17.3ft. Native silt encountered as in TP001.

Begin Trench 10:36 Finish Trench 11:13 Trenching Contractor KW

Total Depth 17.3 Total Length 8

MWH

FILE: Fig__ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

# TRENCH TEST PIT LOG FORM



Project FMC Data Gap Investigation Project Number 10513311

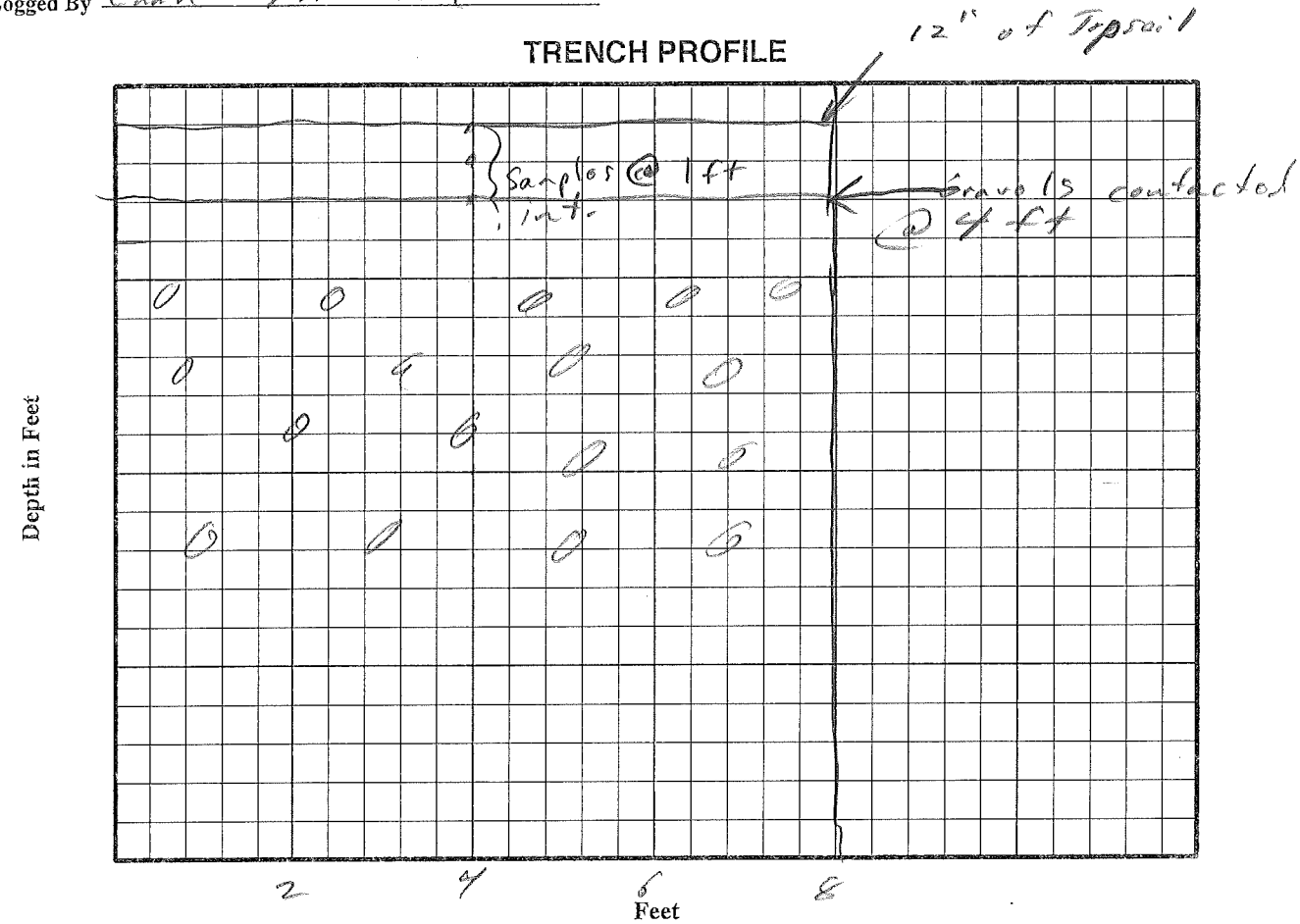
Sample Location WVA Trench Number TP003 Date 10/29/2013

Coordinates: ~~Inside Stake~~ Northing 448827.0 ~~Outside Stake~~ Easting 549003.4

Elevation ~~Native/Fill Stake~~

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

12" of top soil with extensive root structure
3' of silt (refer to TP001 for description of silt)
Gravels contacted @ 4 ft

Begin Trench 11:23 Finish Trench 11:30 Trenching Contractor KW

Total Depth 4 ft Total Length 8

MWH

FILE: Fig__ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

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FMC

# TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation Project Number 10503311

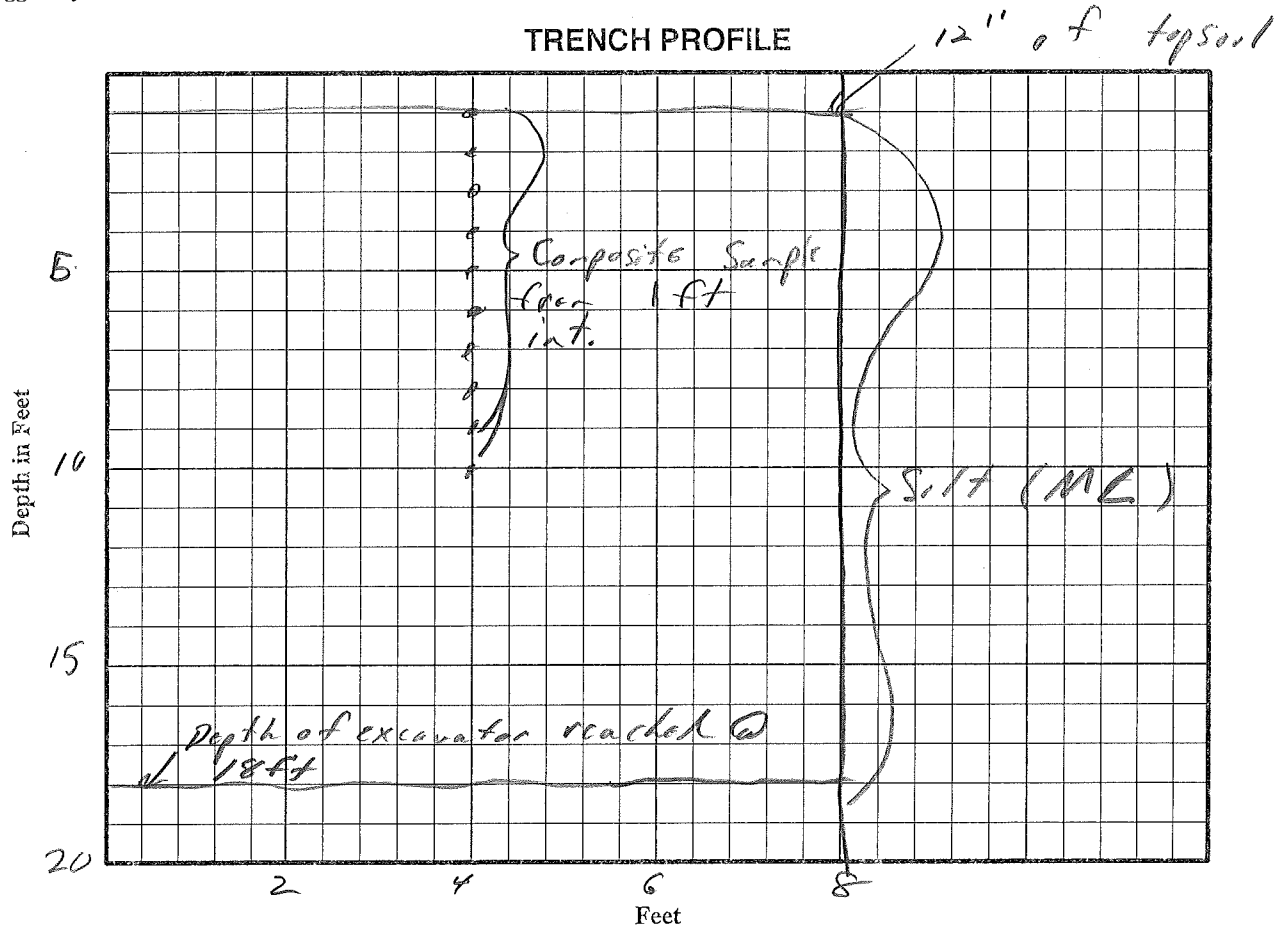
Sample Location WUA Trench Number TP004 Date 10/29/2013

Coordinates: ~~Inside Stake~~ Northing 448196.6 ~~Outside Stake~~ Easting 549171.6

Elevation ~~Native/fill Stake~~ 4453.5

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for description of silt

Begin Trench 13:25 Finish Trench 13:55 Trenching Contractor KW

Total Depth 18 Total Length 8

MWH

FILE: Fig __ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

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FMC

# TRENCH TEST PIT LOG FORM



Project FMC Data Gap Investigation Project Number 10503311

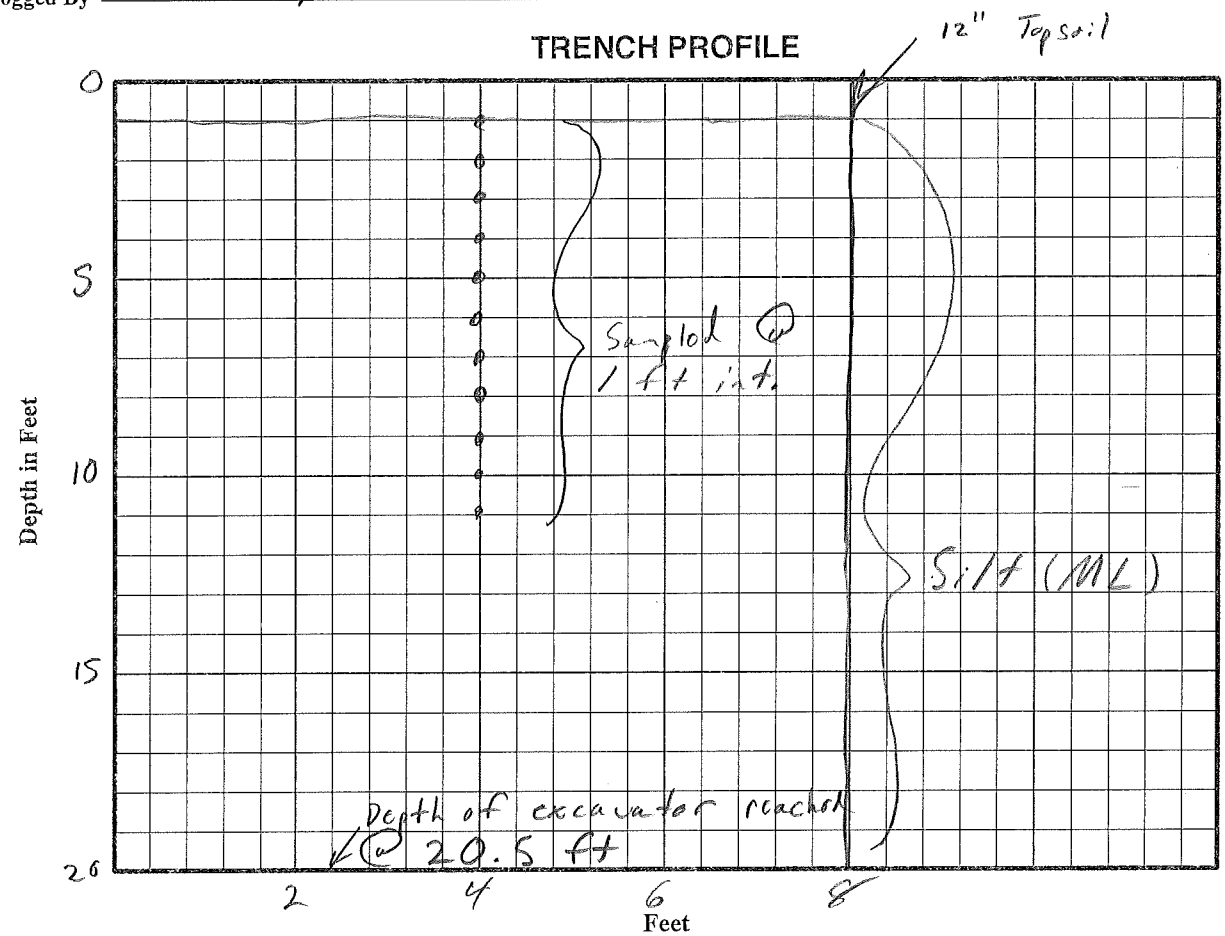
Sample Location WVA Trench Number TP005 Date 10/29/2013

Coordinates: ~~Inside Stake~~ Northing 447835.6 ~~Outside Stake~~ Easting 548187.9

~~Easting~~ ~~Native/Fill Stake~~ Elevation 4450.5

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for description of silt

Begin Trench 14:05 Finish Trench 14:37 Trenching Contractor KW

Total Depth 20.5 ft Total Length 8

MWH

FILE: Fig__ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

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FMC

# TRENCH TEST PIT LOG FORM



Project FMC Data Gap Investigation Project Number 10503311

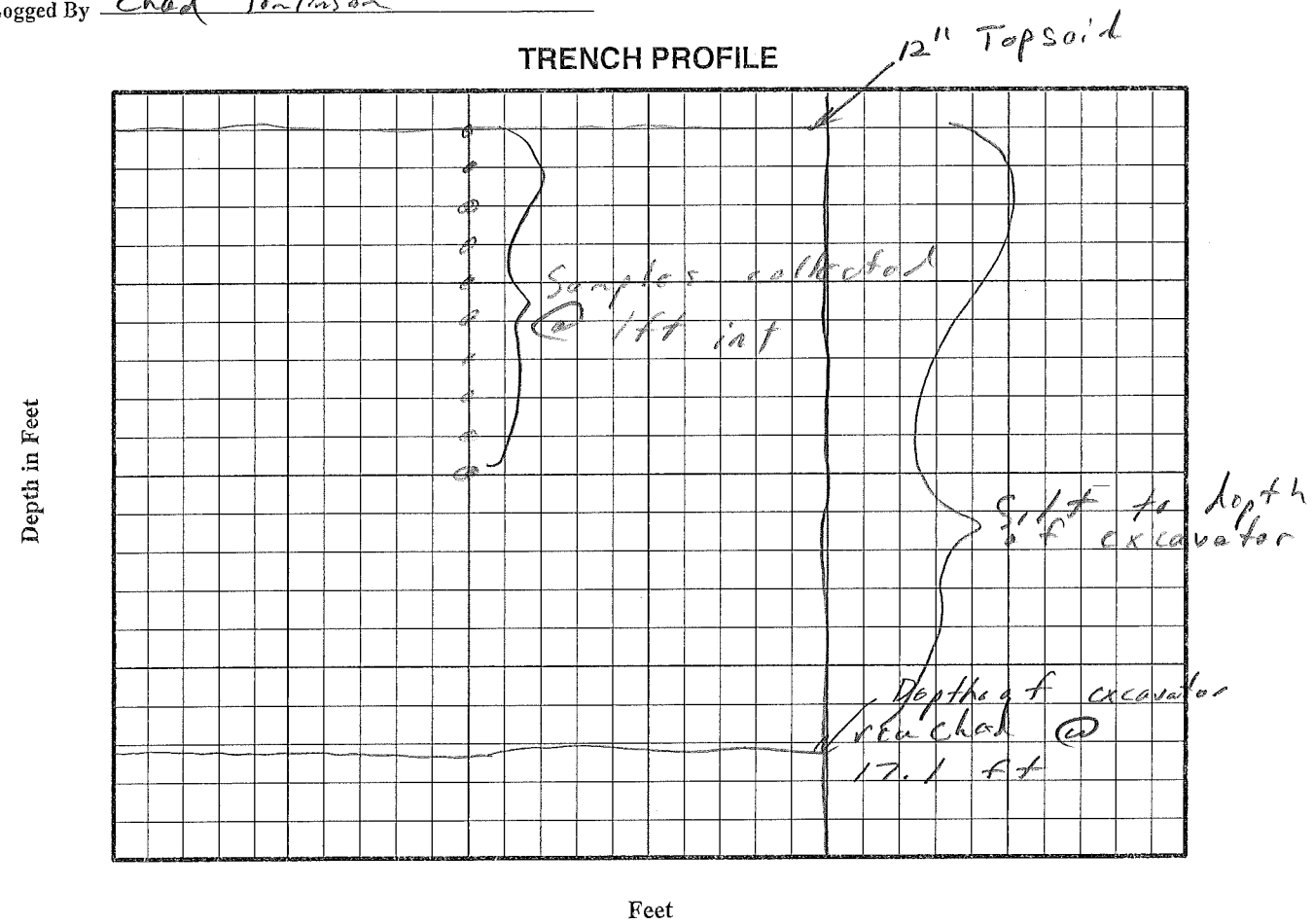
Sample Location WUA Trench Number TP006 Date 10/29/2013

Coordinates: ~~Inside Stake~~ Northing 447529.7 ~~Outside Stake~~ Easting 547237.3

Elevation ~~Native/Fill Stake~~ 4454.9

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for description of silt

Begin Trench 14:45 Finish Trench 15:11 Trenching Contractor KW

Total Depth 17.1 ft Total Length ~ 8 ft

MWH

FILE: Fig __ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

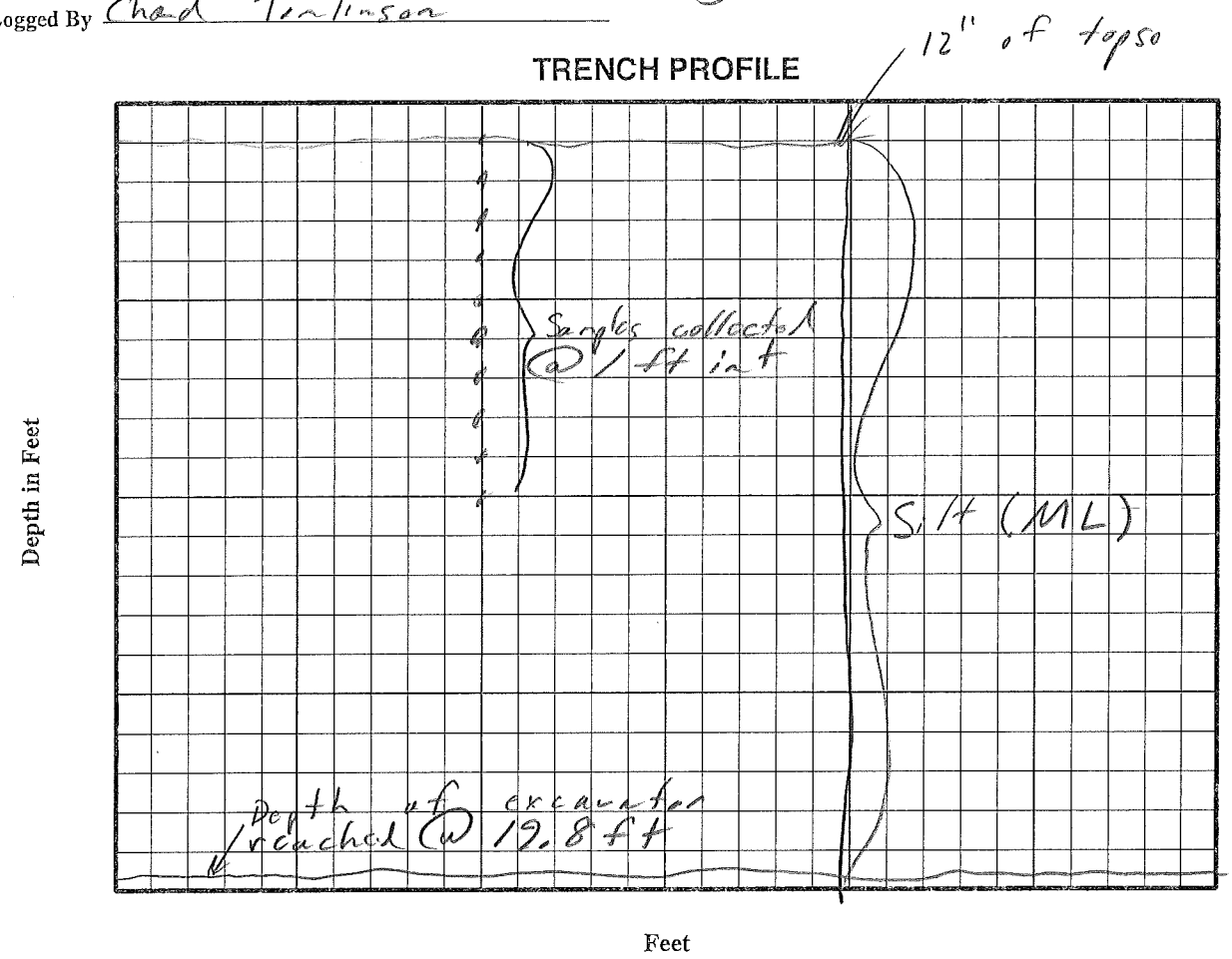
FMC

# TRENCH TEST PIT LOG FORM



Project FMC Data Gap Invest
Project Number 10503311
Sample Location WUA
Trench Number TP007
Date 10/30/13
Coordinates: ~~Inside Stake~~ Northing 448275.4
~~Outside Stake~~ Easting 547160.5
Elev ~~Native/Fill Stake~~ 4452.9
Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for Silt description

Begin Trench 10:20
Finish Trench 10:48
Trenching Contractor KW
Total Depth 19' 2"
Total Length 8

MWH

FILE: Fig__ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

# TRENCH TEST PIT LOG FORM

Page ____ of ____

Project FMC Data Gap Invest  Project Number 10503311

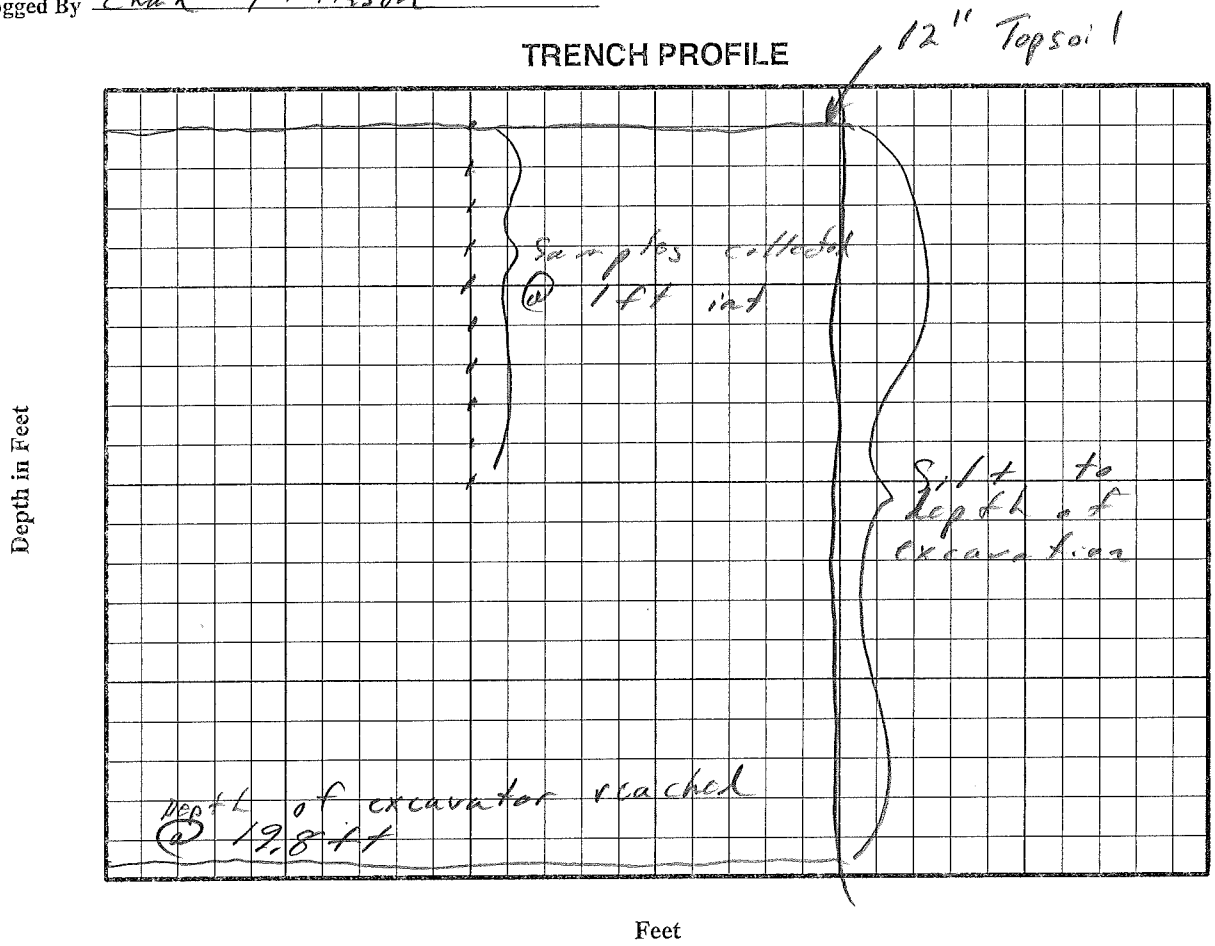
Sample Location WVA  Trench Number TP008  Date 10/30/13

Coordinates: ~~Inside Stake~~ Northing 449010.0  ~~Outside Stake~~ Easting 547194.5

Elev  ~~Native/Fill Stake~~ 4451.7

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for silt description

Begin Trench 11:00  Finish Trench 11:33  Trenching Contractor KW

Total Depth 19'8"  Total Length 8

MWH

FILE: Fig __ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

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FMC

# TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investi. Project Number 10503311

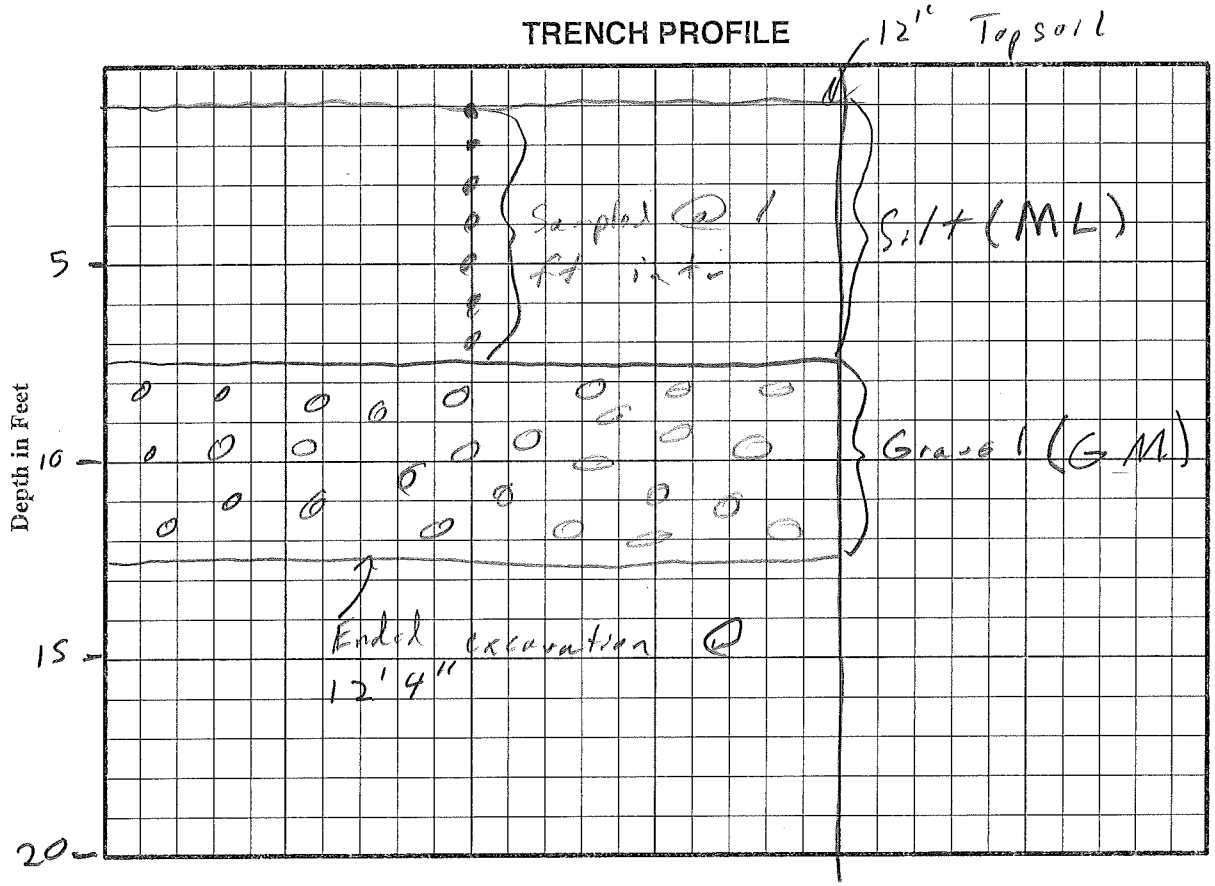
Sample Location WUA Trench Number TP009 Date 10/30/13

Coordinates: ~~Inside Stake~~ N 448471.8 ~~Outside Stake~~ E 547809.6

Elev ~~Native/Fill Stake~~ 4448.0

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for soil description

Begin Trench 11:49 Finish Trench 12:07 Trenching Contractor KW

Total Depth 12' 4" Total Length 8

MWH

FILE: Fig__ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

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FMC

# TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Invest  Project Number 10 503311

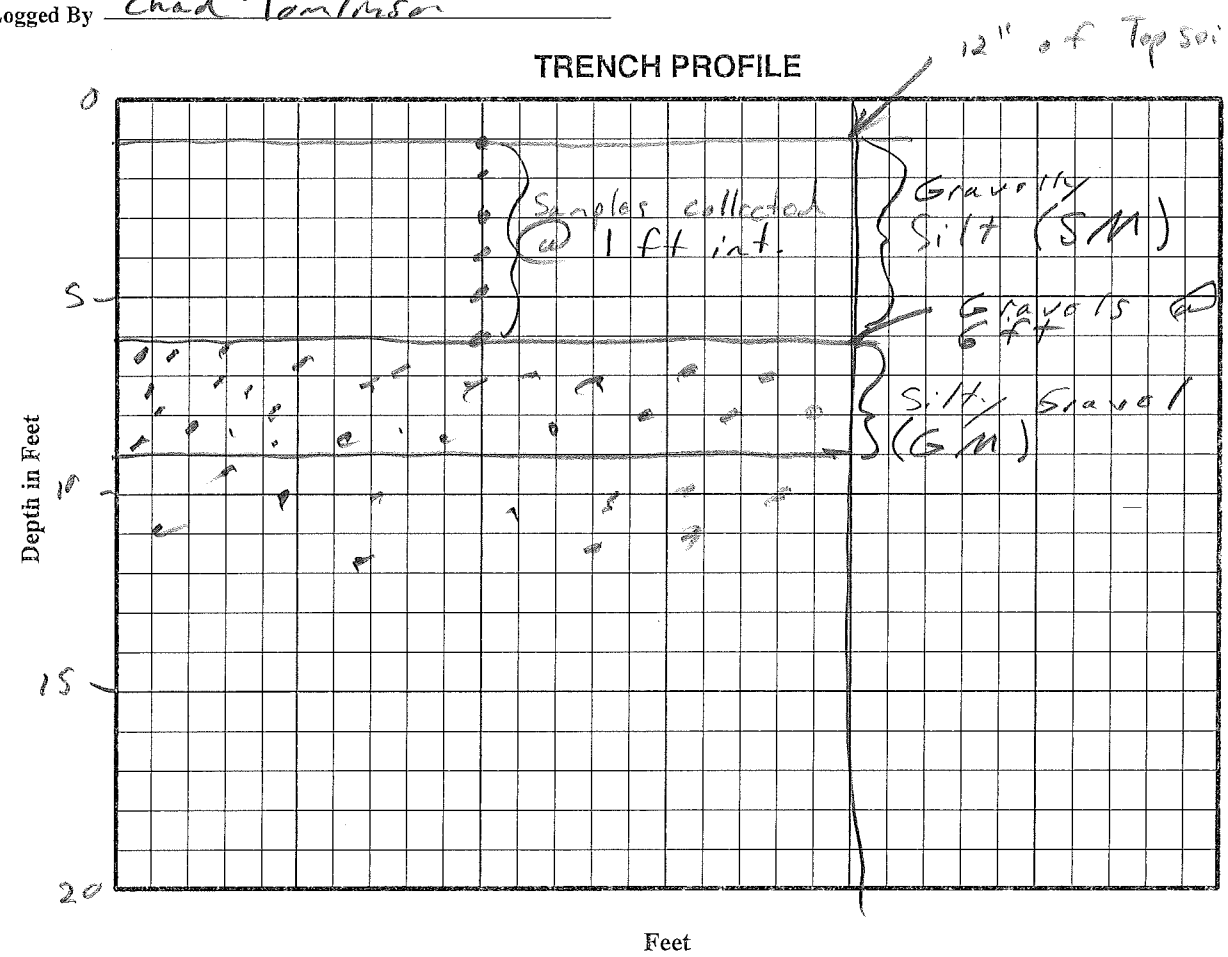
Sample Location WVA  Trench Number TP010  Date 10/30/13

Coordinates: ~~Inside Stake~~ N 448557.3  ~~Outside Stake~~ E 548356.9

Elev ~~Native/Fill Stake~~ 4446.2

Logged By Chad Tomlinson

## TRENCH PROFILE




Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Gravels (GM) encountered @ 6 ft excavated down to 9 ft and still in gravels. Excavated additional exploratory borings N + S of TP010. Appears that shallow gravels extend approx 300 ft N + S of TP010

Begin Trench 12:25  Finish Trench 13:00  Trenching Contractor KW

Total Depth 9  Total Length 8

MWH

FILE: Fig __ FMC Trench profile.ai 1004503.010505 03/06/2006 SLC

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FMC

# DAILY QUALITY CONTROL REPORT

DATE 10/29/13

| DAY | S | M | T | W | TH | F | S |
|---|---|---|---|---|---|---|---|
| | | | X | | | | |

| WEATHER | Bright Sun | Clear | Overcast | Rain | Snow |
|---|---|---|---|---|---|
| | | | X | | |

| TEMP | To 32 | 32–50 | 50–70 | 75–85 | 85 up |
|---|---|---|---|---|---|
| | | X | | | |

| WIND | Still | Moder. | High | Report No. |
|---|---|---|---|---|
| | | X | | |

| HUMIDITY | Dry | Moder. | Humid | |
|---|---|---|---|---|
| | | X | | DGFI-1 |

PROJECT FMC Data Gap Investigation
JOB NO. 10503311
LOCATION WVA
CONTRACT NO.

PERSONNEL AND SUBCONTRACTORS ON SITE:

KW: Mark Smith, Rick, Tribe: Kelly Wright
MWH: Chad Tomlinson Booze

VISITORS ON SITE:

EQUIPMENT ON SITE: Trackhoe, frontend loader, shovels, buckets

WORK PERFORMED (INCLUDING SAMPLING):

Excavated TP001, TP002, TP003, TP004, TP005 and TP006. Collected samples from every 1 ft interval down to approximately 10 ft. Filled 2 5-gallon buckets at each test pit. Continued excavation below 10 ft until underlying gravels reached or depth of excavator met. Gravels contacted in 2 test pits: 1) TP001 @ 15.7 ft and 2) TP003 @ 4 ft. TP002, TP004, TP005, and TP006 excavated to total depth of excavator generally around 17.5 to 20 ft bgs.



MWH

FILE: FMC Daily Quality.ai 1004503.010505 02/24/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

(Continuation Sheet)

PROJECT FMC Data Gap Field Investigation REPORT NO. DGFI-1

JOB NO. 105 03311 DATE 10/29/13

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

No field measurements completed

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Level D (modified)

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

Complete remaining test pits

DISTRIBUTION : 1. MW PROJECT MANAGER
2. PROJECT FILE

Page 2 of 2

SUBMITTED BY Chad Tomlinson TITLE Project Engineer

MWH

FILE: Fig 4-1b FMC Daily Quality.ai 1004503.010505 02/24/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

# DAILY QUALITY CONTROL REPORT

DATE 10/30/13

| DAY | S | M | T | W | TH | F | S |
|---|---|---|---|---|---|---|---|
| | | | | X | | | |

| WEATHER | Bright Sun | Clear | Overcast | Rain | Snow |
|---|---|---|---|---|---|
| | | | X | | |

| TEMP | To 32 | 32–50 | 50–70 | 75–85 | 85 up |
|---|---|---|---|---|---|
| | | | X | | |

| WIND | Still | Moder. | High | Report No. |
|---|---|---|---|---|
| | | | X | DGFI-1 |

| HUMIDITY | Dry | Moder. | Humid |
|---|---|---|---|
| | | X | |

PROJECT FMC Data Gap Investigation
JOB NO. D 105033 11
LOCATION WVA
CONTRACT NO.

PERSONNEL AND SUBCONTRACTORS ON SITE:
KW: Mark Smith, Rick,
MWH: Chad Jonlinson

VISITORS ON SITE:

EQUIPMENT ON SITE: Trackhoe, front-end loader, shovels, buckets

WORK PERFORMED (INCLUDING SAMPLING):

Excavated TP007 - TP010. TP008 and TP010 were only test pits that contacted gravels.
TP008 gravels @ 7.5 ft
TP010 gravels @ 6 ft
Performed additional test pits to define N-S extent of gravels @ TP000. Appears that gravels extend approximately 300 ft N and S of TP010 and in line with TP003 and TP009. Excavated additional test pit in southwest corner of existing borrow source. Excavated down to 20 ft below existing grade (10 below natural) w/o hitting gravels.



MWH

FILE: FMC Daily Quality.ai 1004503.010505 02/24/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

(Continuation Sheet)

PROJECT FMC Data Gap Investigation REPORT NO. DGFI-2

JOB NO. 10503311 DATE 10/30/13

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

No field tests completed. Took approximate depth measurements of test pits

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Modified Level D

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

None

SPECIAL NOTES:

None

TOMORROW'S EXPECTATIONS:

No activities planned for tomorrow

DISTRIBUTION : 1. MW PROJECT MANAGER
2. PROJECT FILE

Page 2 of 2

SUBMITTED BY Chad Tomlinson TITLE Project Engineer

MWH

FILE: Fig 4-1b FMC Daily Quality.ai 1004503.010505 02/24/2006 SLC

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# APPENDIX C

## Soil Boring Logs

FMC

BORING LOCATION

Project: Data Gap Project No: 10503311
Date Drilled: 11/12/13 Date Completed: 11/12/13
Logged By: B. Bradson

Boring ID: FMC-SB-3
Northing: 498827.0 Easting: 549003.4
Ground Surface Elevation (ft.): 4447.80
Datum: NGVD (1988)

Water Elevation (ft.): N/A
Date Measured: N/A

Total Depth (ft.): 30'
Diameter (in.): 8"

Drilling Contractor: CoreTec / Jeff
Drilling Method: HSA

Abandonment Information: Back filled with soil cuttings

| DEPTH (FEET) | % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 25 | 100 | | | Shelby Tube (GAP) | | ML | | Silt (ML) light gray (10YR 7/2) slightly to low plasticity, dry, few roots and organics, medium stiff | Time 1309 |
| 1 | | | | | | | | | | | |
| 2 | 70 | 15 | 30 | | | | | GM | | Pushed shelby Tube 0-2' in second boring *Rock @ 2' bgs unable to drive shelby Tube from 2-4' Silty fine & coarse gravel (GM) light gray (10YR 7/2) low plasticity, medium dense, dry, sub rounded w/ few sub angular gravels | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | GM | | Shelby Tube Not Collected in GM | |
| | 70 | 15 | 30 | | 15 | C | | | | | |
| 5 | | | | | 25 | | | | | | |

* C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

PAGE 1 OF 4

FILE: FMC MW Log Form pg 1.ai 1004931.010604 04/03/2007 SLC

MWH

FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-GP-3

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | 18 | | | GM | | | 1330 |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | Shelby Tube Not Collected in GM | |
| | | | | | | | | | | ? | |
| 9 | | | | | | | | | | | |
| 10 | 70 | 30 | 25 | | 8 | C | | GP | | fine to medium sandy fine & coarse gravel w/ few cobbles, brown (10YR5/3) dry, dense, subrounded w/ few broken angular gravels, nonplastic | |
| | | | | | 12 | | | | | | |
| 11 | | | | | 10 | | | | | | 1350 |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |

FILE: FMC MW Log Form pg 3.ai 1004931.010604 04/03/2007 SLC

MWH



2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

Project: Data Gap Project No: 10503311
Boring ID.: FMC-SB-3

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | | | 12 | C | | | | | Time |
| | 60 | 30 | 10 | | 16 | | ↑ | GP | | As Above w/ some silt (10%) | |
| 16 | | | | | 16 | | | | | | 1411 |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | 50 | 40 | 10 | | 5 | C | | GP | | fine to coarse sandy fine & coarse gravel, mainly fine gravel, | |
| | | | | | 5 | | | | | yellowish brown (10YR 5/4) dry, non plastic | |
| 21 | | | | | 6 | | ↑ | | | dense, subrounded. | 1419 |
| 22 | | | | | | | | | | | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |

FILE: FMC MW Log Form pg 2.ai 1004931.010604 04/03/2007 SLC

MWH



2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

FMC

Project: Data Gap Project No: 10503311
Boring ID.: FMC-SB-3

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Time |
| 25 | | | | | 6 | C | | GP | | | |
| | 0 | 25 | 100 | | 7 | | | ML | | Silt (ML) Very Pale brown (10YR7/3) | |
| 26 | | | | | 11 | | | | | dry to slightly moist, low plasticity | |
| | | | | | | | | | | medium stiff to stiff. Crumbles under weak finger pressure. | 1427 |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| | 0 | 0 | 100 | | 5 | C | | ML | | ML, As Above @ 25.5' bgs | |
| | | | | | 6 | | | | | TD w/ Augers 30' bgs | |
| 31 | | | | | 8 | | | | | TD w/SPT 31.5' bgs | 1437 |
| | | | | | | | | | | Backfilled w/ soil cuttings from boring. | |
| 32 | | | | | | | | | | | |

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FMC

BORING LOCATION

Project: Databop Project No: 1050331
Date Drilled: 11/12/13 Date Completed: 11/12/13
Logged By: B. Bragson
Water Elevation (ft.): NA
Date Measured: NA
Total Depth (ft.): 30'
Diameter (in.): 8"

Boring ID: FMC SB-4
Northing: 443196.6 Easting: 549171.6
Ground Surface Elevation (ft.): 4453.5
Datum: NGVD (1988)
Drilling Contractor: ConeTec / Joff
Drilling Method: HSA

Abandonment Information: Backfilled with Soil Cuttings

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 100 | | | Jetty | | ML | | Silt (ML) light gray (10YR 7/2) slightly to low plasticity, dry, few roots and organics, medium stiff | Time 1542 |
| 1 | | | | | | | | | | | |
| 2 | | | | | | Shelby Tube | | ML | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | ML | | Pushed Shelby Tube 2'-4' | 1548 |
| 5 | | | | | | | | | | | |

* C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-4

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | Time |
| 6 | | | | | | Shelby Tube | | ML | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | ML | | Pushed Shelby Tube 6'-8' | 1620 |
| 9 | | | | | | | | | | | |
| 10 | Ø | 5 | 100 | | 3 | C | | ML | | Silt (ML) pale brown (10YR 7/3) dry low plasticity, dry, soft to medium stiff. | |
| | | | | | 3 | | | | | | |
| 11 | | | | | 5 | | | | | | 1628 |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311
Boring ID.: FMC SB-4

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | Ø | 25 | 100 | | 7 | C | | ML | | Silt (ML), pale brown (10YR7/3) dry, low to slightly plastic, medium stiff | |
| | | | | | 8 | | | | | | |
| 16 | | | | | 10 | | | | | to stiff. | 1645 |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | Ø | 25 | 100 | | 7 | C | | ML | | Silt (ML) pale brown (10YR7/3) dry, low to slightly plastic, medium stiff to stiff. | |
| | | | | | 14 | | | | | | |
| 21 | | | | | 11 | | | | | | 1654 |
| 22 | | | | | | | | | | | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | GP | | harder drilling about 23.5' Estimated top of Gravel. | |
| 25 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-4

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component of plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | 40 | C | | | | | |
| | | | | | 30 | | ↑ | GP | | fine to medium Sandy fine & coarse | |
| 26 | 60 | 30 | 10 | | 31 | | | | | gravel (GP) w/few cobbles, Pale brown | |
| | | | | | | | | | | (10YR 7/3), dry, non plastic to | |
| 27 | | | | | | | | | | slightly plastic where silty, | 1720 |
| | | | | | | | | | | Dense | |
| 28 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| | 60 | 30 | 10 | | 6 | C | | GP | | fine to medium sandy fine & coarse | |
| | | | | | 7 | | ↑ | | | gravel (GP), Pale brown (10YR 7/3) | |
| | | | | | 19 | | | | | dry, non plastic, medium dense | |
| | | | | | | | | | | to dense. | |
| | | | | | | | | | | TD 30' w/ HSA 31.5' w/ split sp. | 1735 |
| | | | | | | | | | | Back filled with soil cuttings | |
| | | | | | | | | | | from boring. | |

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FMC

BORING LOCATION

Project: FMC Project No: 10503311
Date Drilled: 1/13/13 Date Completed: 1/13/13
Logged By: Bill Braggdon
Water Elevation (ft.): NA
Date Measured: NA
Total Depth (ft.): 30'
Diameter (in.): 8"

Boring ID: FMC-SB-6
Northing: 417529.7 Easting: 547237.3
Ground Surface Elevation (ft.): 4454.9
Datum: NGVD (1988)
Drilling Contractor: Cone Tec / Jeff
Drilling Method: HSA

Abandonment Information: Back filled with soil cuttings.

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ø | <5 | 100 | | | SPT | | ML | | Silt (ML) light gray (10YR 7/2) to Pale brown (10YR 7/3), slightly to low plasticity, medium stiff, few roots and organics. | TIME 0853 |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | ML | | | |
| 3 | | | | | | Shelby Tube | | | | | |
| 4 | | | | | | | | ML | | Pushed Shelby Tube 2'-4' | 906 |
| 5 | | | | | | | | | | | |

* C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

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MWH

FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-6

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | Time |
| 6 | | | | | | | | | | | |
| | | | | | | | | ML | | | |
| 7 | | | | | | | | | | | |
| | | | | | | | | ML | | Pushed Shelby Tube 6-8' | |
| 8 | | | | | | | | | | | 931 |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| | Ø | 15 | 10 | | 3 | C | | ML | | silt (ML) yellowish brown (10YR5/4) dry, low plasticity, soft. | |
| | | | | | 3 | | | | | | |
| 11 | | | | | 3 | | | | | | 940 |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311
Boring ID.: FMC SB-6

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | | | | | | | | | Time |
| | Ø | 15 | 10 | | 6 | C | ↑ | ML | | silt (ML) yellowish brown (10YR5/4) dry to slightly moist, slightly | |
| | | | | | 8 | | | | | | |
| 16 | | | | | 8 | | | | | plastic, medium stiff. | |
| | | | | | | | | | | | 949 |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| | | | | | 8 | C | ↑ | | | | |
| | | | | | 10 | | | ML | | ML as above @ 15' | |
| 21 | 60 | 30 | 10 | | 20 | | | GP | | fine to medium sandy fine & coarse gravel (GP), Pale Brown (10YR 6/3) | 959 |
| 22 | | | | | | | | | | NP, dry, medium dense. Fine to medium grained qtzite subrounded gravel. | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-6

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | 13 | C | | GP | | | Time |
| | | | | | 18 | | | | | | |
| 26 | 60 | 30 | 10 | | 19 | | ↑ | | | As Above @ 21' bgs | 1022 |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | TD w/ augers 30' | |
| | | | | | 10 | C | | GP | | As above @ 21' bgs. weak Feox on gf/zite. | |
| | | | | | 18 | | | | | | |
| | 60 | 30 | 10 | | 20 | | ↑ | | | TD w/ SPT 31.5 Back filled with soil cuttings around boring. | 1035 |

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FMC

BORING LOCATION

Project: Data Gap Project No: 1050331
Date Drilled: 11/13/13 Date Completed: 11/13/13
Logged By: Bill Bragdon
Water Elevation (ft.): NA
Date Measured: NA
Total Depth (ft.): 30'
Diameter (in.) 8"

Boring ID: FMC-SB-7
Northing: 448295.4 Easting: 547160.5
Ground Surface Elevation (ft.): 4452.9
Datum: NGVD (1988)
Drilling Contractor: CeneTec/Jeff
Drilling Method: HSA

Abandonment Information: Backfilled with Soil Cuttings

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Ø | 15 | 100 | | | GRAB | | ML | | Silt (ML), pale brown (10YR 6/3) Slightly to low plasticity, medium stiff, dry. | Time 1103 |
| 1 | | | | | | | | ML | | | |
| 2 | | | | | | | | ML | | | |
| 3 | | | | | | Shelby Tube | | ML | | | |
| 4 | | | | | | | | ML | | Pushed Shelby Tube 2-4' | 1115 |
| 5 | | | | | | | | | | | |

* C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-7

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | Time |
| 6 | | | | | | | | ML | | | |
| 7 | | | | | | Shelby Tube | | | | | |
| 8 | | | | | | | | ML | | Pushed Shelby Tube 6'-8' | 1140 |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | 1140 |
| | Ø | 5 | 10 | | 4 | C | | ML | | Silt (ML) very pale brown (10YR 7/3) dry, low to slightly plastic | |
| | | | | | 5 | | | | | | |
| 11 | | | | | 7 | | | | | soft to medium stiff. | 1142 |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | Pushed Shelby Tube 12'-14' | 1202 |
| 15 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311
Boring ID.: FMC-SB-7

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | | | | | | ML | | | Time |
| | Ø | 60 | 40 | | 5 | C | | SM | | Silty fine to coarse sand (SM) | |
| | | | | | 7 | | | | | Pale brown (10YR 6/4), dry | |
| 16 | | | | | 6 | | | | | Non plastic to slightly plastic where silty. | 1209 |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| | Ø | 15 | 100 | | 7 | C | | ML | | Silt (ML) pale brown (10YR 6/4) | |
| | | | | | 8 | | | | | dry, low to slightly plastic medium | |
| 21 | | | | | 12 | | | | | stiff to stiff. | 1216 |
| 22 | | | | | | | | | | | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | GP | | Harder drilling. Estimated top of Gravel. | |

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FMC

Project: Data Gap Project No: 10503311
Boring ID.: FMC-SB-7

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | | | | | | | Time |
| | 60 | 40 | 25 | | 38 | C | | GP | | fine to coarse sandy fine & coarse | |
| | | | | | 22 | | | | | gravel (GP) light gray (10YR 6/2) | |
| 26 | | | | | 21 | | | | | non plastic, dry, medium dense to dense, subrounded. | 1226 |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| | 60 | 30 | 10 | | 14 | C | | GP | | fine to coarse sandy fine & coarse | |
| | | | | | 18 | | | | | gravel (GP) w/some silt, few cobbles | |
| | | | | | 21 | | | | | generally light gray (10YR 6/2) to yellowish brown (10YR 5/4) | 1237 |
| | | | | | | | | | | dry, medium dense, subrounded gravel | |
| | | | | | | | | | | TD w/HSA 30' TD w/Sampler 31.5' | |
| | | | | | | | | | | Back filled w/soil from boring. | |

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FMC

BORING LOCATION

Project: Data Gap Project No: 10503311
Date Drilled: 11/13/13 Date Completed: 11/13/13
Logged By: Bill Bragdon
Water Elevation (ft.): NA
Date Measured: NA
Total Depth (ft.): 30'
Diameter (in.) 8"

Boring ID: FMC-SB-8
Northing: 449010.0 Easting: 541945
Ground Surface Elevation (ft.): 4451.7
Datum: NGVD (1988)
Drilling Contractor: CanTec / Jeff
Drilling Method: HSA

Abandonment Information: Back filled with soil cuttings.

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Ø | 15 | 100 | | | Grab | | ML | | Silt (ML) pale brown (10YR6/3) to yellowish brown (10YR5/4), slightly moist, slightly to low plasticity. | Time 1305 |
| 1 | | | | | | | | | | medium stiff, few roots & organics | |
| 2 | | | | | | | | ML | | | 13/8 |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | ML | | Pushed Shelby Tube 2'-4' | 1325 |
| 5 | | | | | | | | | | | |

* C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-8

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | Time |
| 6 | | | | | | | | ML | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | ML | | Pushed Shelby Tube 6'-8' | 1334 |
| 9 | | | | | | | | | | | |
| 10 | Ø | 6 | 100 | | 3 | C | | ML | | Silt (ML) pale brown (10YR 6/3) | |
| | | | | | 7 | | ↑ | | | dry, low to slightly plastic | |
| 11 | | | | | 9 | | | | | medium stiff to stiff | 1343 |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-8

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | | | | | | | | | Time |
| | Ø | 25 | 100 | | 4 | C | ↑ | ML | | Silt (ML) pale brown (10YR 6/3) low to slightly plastic, dry, soft to medium stiff | |
| | | | | | 6 | | | | | | |
| 16 | | | | | 8 | | | | | | 1351 |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| | Ø | 25 | 100 | | 8 | C | ↑ | ML | | silt (ML) pale brown (10YR 6/3) low to slightly plasticity, dry, medium stiff. | |
| | | | | | 7 | | | | | | |
| 21 | | | | | 9 | | | | | | 1400 |
| 22 | | | | | | | | | | | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |

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FMC

Project: Data Gap Project No: 10503311

Boring ID.: FMC-SB-8

| DEPTH (FEET) | GRAIN SIZE % GRAVEL | % SAND | % FINES | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | | | | | | | Time |
| | Ø | 15 | 100 | | 8 | C | | ML | | Silt (ML) pale brown (10YR6/3) to moderate yellowish brown (10YR5/4) dry, slightly to low plasticity medium stiff to stiff | |
| | | | | | 9 | | | | | | |
| 26 | | | | | 15 | | | | | | 1417 |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| | Ø | 15 | 100 | | 8 | C | | ML | | Silt (ML) moderate yellowish brown (10YR5/4), dry, low to slightly plastic, medium stiff to stiff. | |
| | | | | | 13 | | | | | | |
| | | | | | 22 | | | GP | | Gravel caught in shoe, very hard the last 3" of run | 1440 |
| | | | | | | | | | | TDW/HSA 30' w/ SPT 31.5' | |
| | | | | | | | | | | Backfilled with soil cuttings from boring | |

FILE: FMC MW Log Form pg 3.ai 1004931.010604 04/03/2007 SLC

MWH



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# APPENDIX D

## Geotechnical and Hydrological Testing Reports

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# Water Content and Unit Weight of Soil

**(In General Accordance with ASTM D7263 Method B and D2216)**

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**Project:** **MWH**
**No:** **00303-014**
Location: FMC RDRA Data Gap Investigation
Date: 11/27/2013
By: JDF

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Info. | Boring No. | SB8 | SB8 | SB3 | SB4 | SB4 | SB6 | SB6 | SB7 |
| | Sample: | | | | | | | | |
| | Depth: | 2-4' | 6-8' | 0-2' | 2-4' | 6-8' | 2-4' | 6-8' | 2-4' |
| Unit Weight Info. | Sample height, H (in) | 4.427 | 4.492 | 4.663 | 4.000 | 6.051 | 4.409 | 5.159 | 4.921 |
| | Sample diameter, D (in) | 2.885 | 2.882 | 2.883 | 2.884 | 2.884 | 2.882 | 2.882 | 2.883 |
| | Sample volume, V ($ft^3$) | 0.0167 | 0.0170 | 0.0176 | 0.0151 | 0.0229 | 0.0166 | 0.0195 | 0.0186 |
| | Mass rings + wet soil (g) | 1721.56 | 1721.15 | 1848.02 | 1801.18 | 2045.31 | 1763.78 | 1151.00 | 1797.87 |
| | Mass rings/tare (g) | 1068.76 | 1075.67 | 1087.08 | 1244.25 | 1186.90 | 1067.18 | 361.78 | 1111.81 |
| | Moist soil, Ws (g) | 652.80 | 645.48 | 760.94 | 556.93 | 858.41 | 696.60 | 789.22 | 686.06 |
| | Moist unit wt., $\gamma_m$ (pcf) | 85.93 | 83.92 | 95.23 | 81.20 | 82.73 | 92.27 | 89.34 | 81.36 |
| Water Content | Wet soil + tare (g) | 768.44 | 738.89 | 477.75 | 661.30 | 430.10 | 524.88 | 587.23 | 354.56 |
| | Dry soil + tare (g) | 718.97 | 690.41 | 461.22 | 636.71 | 413.13 | 472.91 | 547.48 | 324.20 |
| | Tare (g) | 126.82 | 124.36 | 124.42 | 124.41 | 128.35 | 127.69 | 123.36 | 128.51 |
| **Water Content, w (%)** | | **8.4** | **8.6** | **4.9** | **4.8** | **6.0** | **15.1** | **9.4** | **15.5** |
| **Dry Unit Wt., $\gamma_d$ (pcf)** | | **79.3** | **77.3** | **90.8** | **77.5** | **78.1** | **80.2** | **81.7** | **70.4** |

Entered by:_____

Reviewed:_____

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# Water Content and Unit Weight of Soil

**(In General Accordance with ASTM D7263 Method B and D2216)**

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**Project:** **MWH**
**No:** **00303-014**
Location: FMC RDRA Data Gap Investigation
Date: 12/16/2013
By: JDF

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Info. | Boring No. | SB7 | SB7 | | | | | | |
| | Sample: | | | | | | | | |
| | Depth: | 6-8' | 12-14' | | | | | | |
| Unit Weight Info. | Sample height, H (in) | 2.770 | 4.443 | | | | | | |
| | Sample diameter, D (in) | 2.884 | 2.798 | | | | | | |
| | Sample volume, V ($ft^3$) | 0.0105 | 0.0158 | | | | | | |
| | Mass rings + wet soil (g) | 628.36 | 800.26 | | | | | | |
| | Mass rings/tare (g) | 152.04 | 168.60 | | | | | | |
| | Moist soil, Ws (g) | 476.32 | 631.66 | | | | | | |
| | Moist unit wt., $\gamma_m$ (pcf) | 100.28 | 88.08 | | | | | | |
| Water Content | Wet soil + tare (g) | 296.80 | 754.94 | | | | | | |
| | Dry soil + tare (g) | 287.40 | 738.11 | | | | | | |
| | Tare (g) | 128.47 | 223.39 | | | | | | |
| **Water Content, w (%)** | | **5.9** | **3.3** | | | | | | |
| **Dry Unit Wt., $\gamma_d$ (pcf)** | | **94.7** | **85.3** | | | | | | |

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Reviewed:_____

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/12/2013
By: BRR

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

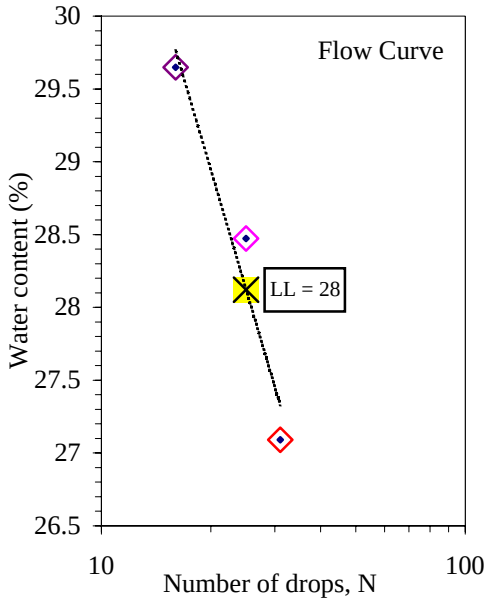
**Plastic Limit**

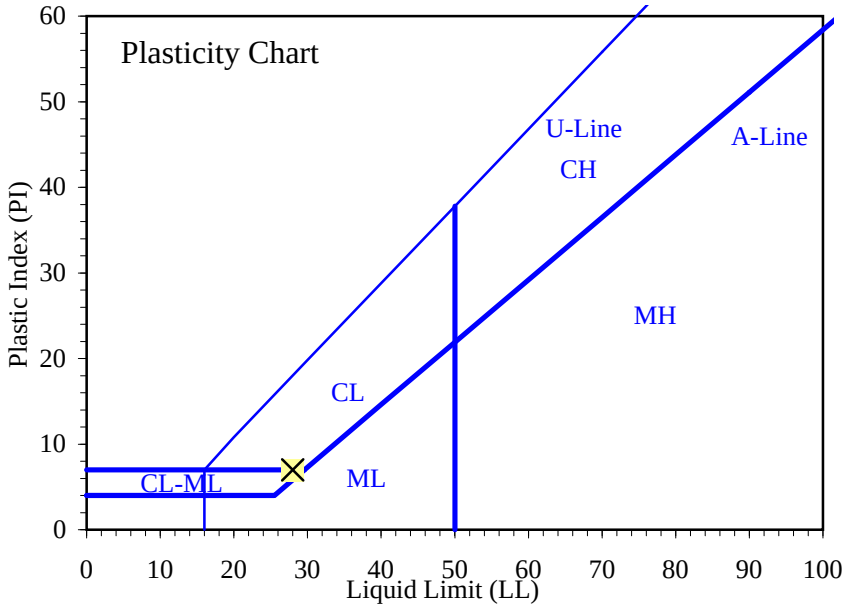
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 31.64 | 32.88 | | | | |
| Dry Soil + Tare (g) | 30.00 | 31.03 | | | | |
| Water Loss (g) | 1.64 | 1.85 | | | | |
| Tare (g) | 22.14 | 22.07 | | | | |
| Dry Soil (g) | 7.86 | 8.96 | | | | |
| Water Content, w (%) | 20.87 | 20.65 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 31 | 25 | 16 | | | |
| Wet Soil + Tare (g) | 31.38 | 30.95 | 32.16 | | | |
| Dry Soil + Tare (g) | 29.34 | 28.88 | 29.88 | | | |
| Water Loss (g) | 2.04 | 2.07 | 2.28 | | | |
| Tare (g) | 21.81 | 21.61 | 22.19 | | | |
| Dry Soil (g) | 7.53 | 7.27 | 7.69 | | | |
| Water Content, w (%) | 27.09 | 28.47 | 29.65 | | | |
| One-Point LL (%) | | 28 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **28** |
| **Plastic Limit, PL (%)** | **21** |
| **Plasticity Index, PI (%)** | **7** |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/12/2013
By: BRR

**Boring No.:** WUA-TP002-01
**Sample:**
**Depth:** 1-10'
Description: Brown lean clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

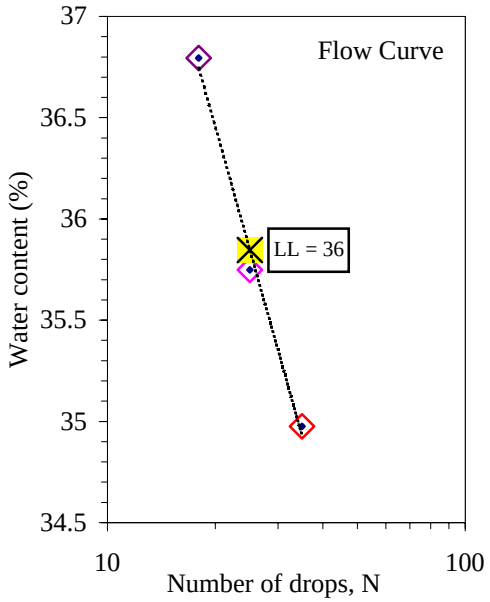
**Plastic Limit**

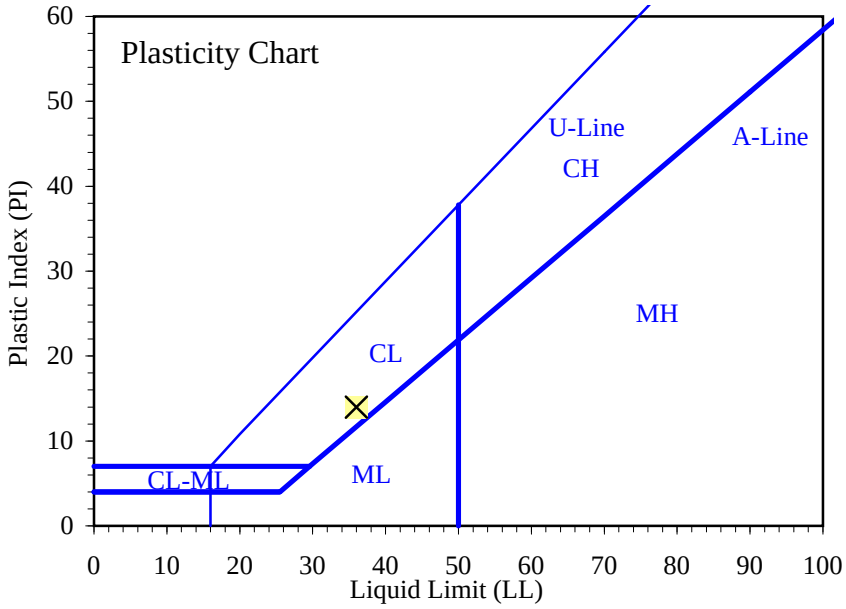
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 30.52 | 29.74 | | | | |
| Dry Soil + Tare (g) | 29.02 | 28.38 | | | | |
| Water Loss (g) | 1.50 | 1.36 | | | | |
| Tare (g) | 22.04 | 22.12 | | | | |
| Dry Soil (g) | 6.98 | 6.26 | | | | |
| Water Content, w (%) | 21.49 | 21.73 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 35 | 25 | 18 | | | |
| Wet Soil + Tare (g) | 30.40 | 30.70 | 30.85 | | | |
| Dry Soil + Tare (g) | 28.20 | 28.43 | 28.37 | | | |
| Water Loss (g) | 2.20 | 2.27 | 2.48 | | | |
| Tare (g) | 21.91 | 22.08 | 21.63 | | | |
| Dry Soil (g) | 6.29 | 6.35 | 6.74 | | | |
| Water Content, w (%) | 34.98 | 35.75 | 36.80 | | | |
| One-Point LL (%) | | 36 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **36** |
| **Plastic Limit, PL (%)** | **22** |
| **Plasticity Index, PI (%)** | **14** |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/12/2013
By: BRR

**Boring No.:** WUA-TP003-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

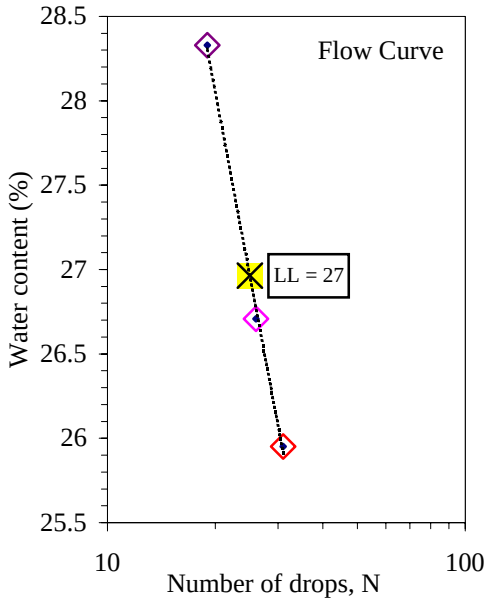
**Plastic Limit**

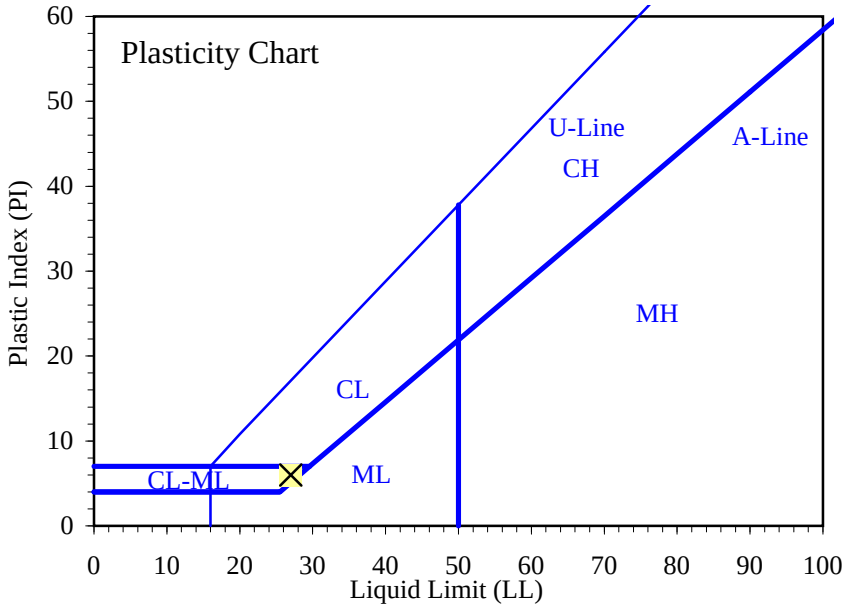
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 30.10 | 32.41 | | | | |
| Dry Soil + Tare (g) | 28.69 | 30.62 | | | | |
| Water Loss (g) | 1.41 | 1.79 | | | | |
| Tare (g) | 22.05 | 22.08 | | | | |
| Dry Soil (g) | 6.64 | 8.54 | | | | |
| Water Content, w (%) | 21.23 | 20.96 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 31 | 26 | 19 | | | |
| Wet Soil + Tare (g) | 30.69 | 30.15 | 30.75 | | | |
| Dry Soil + Tare (g) | 28.85 | 28.43 | 28.75 | | | |
| Water Loss (g) | 1.84 | 1.72 | 2.00 | | | |
| Tare (g) | 21.76 | 21.99 | 21.69 | | | |
| Dry Soil (g) | 7.09 | 6.44 | 7.06 | | | |
| Water Content, w (%) | 25.95 | 26.71 | 28.33 | | | |
| One-Point LL (%) | | 27 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **27** |
| **Plastic Limit, PL (%)** | **21** |
| **Plasticity Index, PI (%)** | **6** |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/14/2013
By: BRR

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

Preparation method: Air Dry
Liquid Limit: Could not be determined (N.P.)

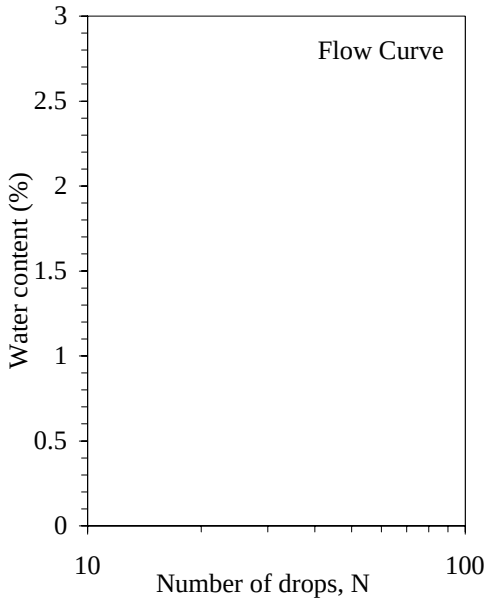
**Plastic Limit**

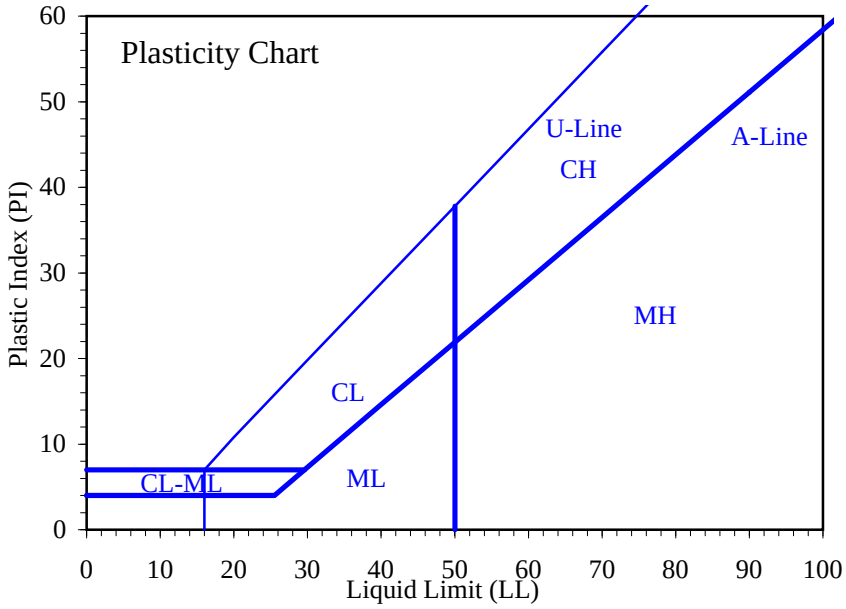
| | | | | | | |
|---|---|---|---|---|---|---|
| Determination No | | | | | | |
| Wet Soil + Tare (g) | | | | | | |
| Dry Soil + Tare (g) | | Difficult to thread. | | | | |
| Water Loss (g) | | | | | | |
| Tare (g) | | | | | | |
| Dry Soil (g) | | | | | | |
| Water Content, w (%) | | | | | | |

**Liquid Limit: Could not be determined (N.P.)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Determination No | | | | | | |
| Number of Drops, N | | | | | | |
| Wet Soil + Tare (g) | Unable to obtain an adequate blow count. | | | | | |
| Dry Soil + Tare (g) | | | | | | |
| Water Loss (g) | | | | | | |
| Tare (g) | | | | | | |
| Dry Soil (g) | | | | | | |
| Water Content, w (%) | | | | | | |
| One-Point LL (%) | | | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **Nonplastic (N.P.)** |
| **Plastic Limit, PL (%)** | |
| **Plasticity Index, PI (%)** | |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

**(ASTM D4318)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/14/2013
By: BRR

**Boring No.:** WUA-TP005-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

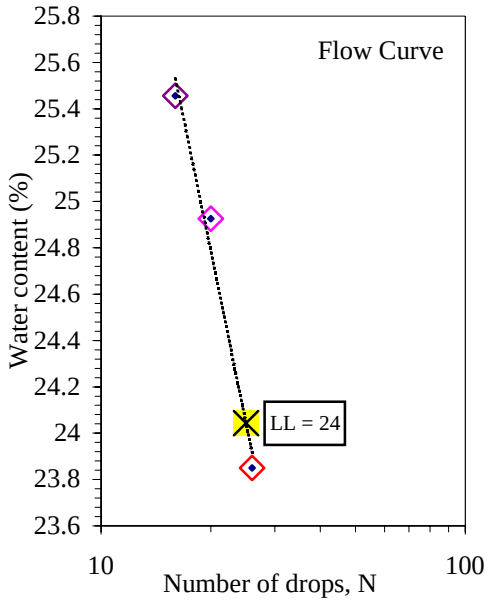
**Plastic Limit**

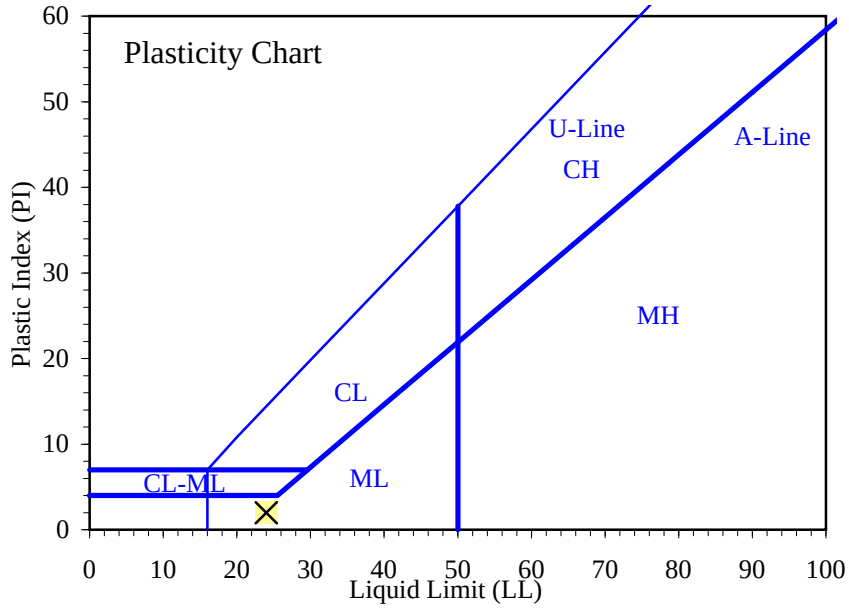
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 29.97 | 33.78 | | | | |
| Dry Soil + Tare (g) | 28.49 | 31.70 | | | | |
| Water Loss (g) | 1.48 | 2.08 | | | | |
| Tare (g) | 21.64 | 22.04 | | | | |
| Dry Soil (g) | 6.85 | 9.66 | | | | |
| Water Content, w (%) | 21.61 | 21.53 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 26 | 20 | 16 | | | |
| Wet Soil + Tare (g) | 33.17 | 30.30 | 33.04 | | | |
| Dry Soil + Tare (g) | 30.89 | 28.62 | 30.81 | | | |
| Water Loss (g) | 2.28 | 1.68 | 2.23 | | | |
| Tare (g) | 21.33 | 21.88 | 22.05 | | | |
| Dry Soil (g) | 9.56 | 6.74 | 8.76 | | | |
| Water Content, w (%) | 23.85 | 24.93 | 25.46 | | | |
| One-Point LL (%) | 24 | 24 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **24** |
| **Plastic Limit, PL (%)** | **22** |
| **Plasticity Index, PI (%)** | **2** |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/14/2013
By: BRR

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

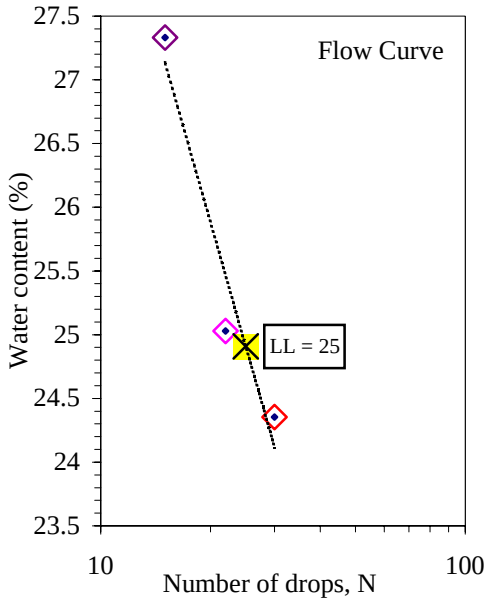
**Plastic Limit**

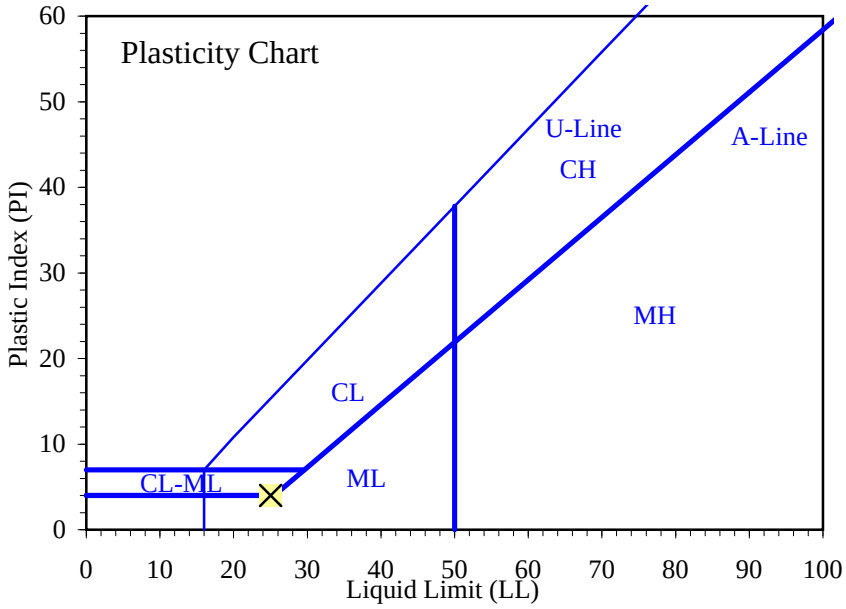
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 31.07 | 31.18 | | | | |
| Dry Soil + Tare (g) | 29.41 | 29.55 | | | | |
| Water Loss (g) | 1.66 | 1.63 | | | | |
| Tare (g) | 21.70 | 21.80 | | | | |
| Dry Soil (g) | 7.71 | 7.75 | | | | |
| Water Content, w (%) | 21.53 | 21.03 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 30 | 22 | 15 | | | |
| Wet Soil + Tare (g) | 32.11 | 32.92 | 31.87 | | | |
| Dry Soil + Tare (g) | 30.13 | 30.69 | 29.76 | | | |
| Water Loss (g) | 1.98 | 2.23 | 2.11 | | | |
| Tare (g) | 22.00 | 21.78 | 22.04 | | | |
| Dry Soil (g) | 8.13 | 8.91 | 7.72 | | | |
| Water Content, w (%) | 24.35 | 25.03 | 27.33 | | | |
| One-Point LL (%) | 25 | 25 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **25** |
| **Plastic Limit, PL (%)** | **21** |
| **Plasticity Index, PI (%)** | **4** |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/12/2013
By: BRR

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

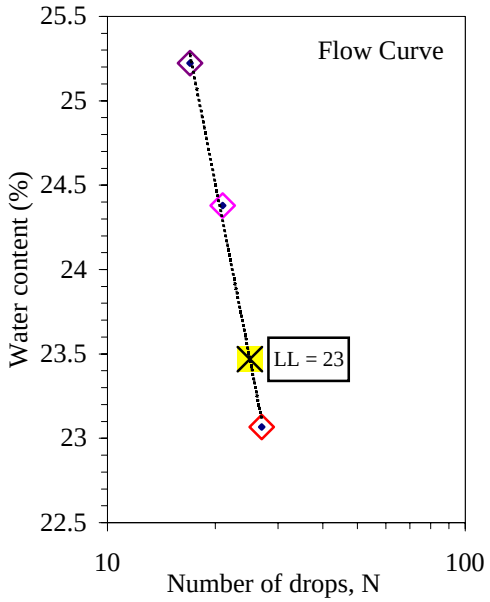
**Plastic Limit**

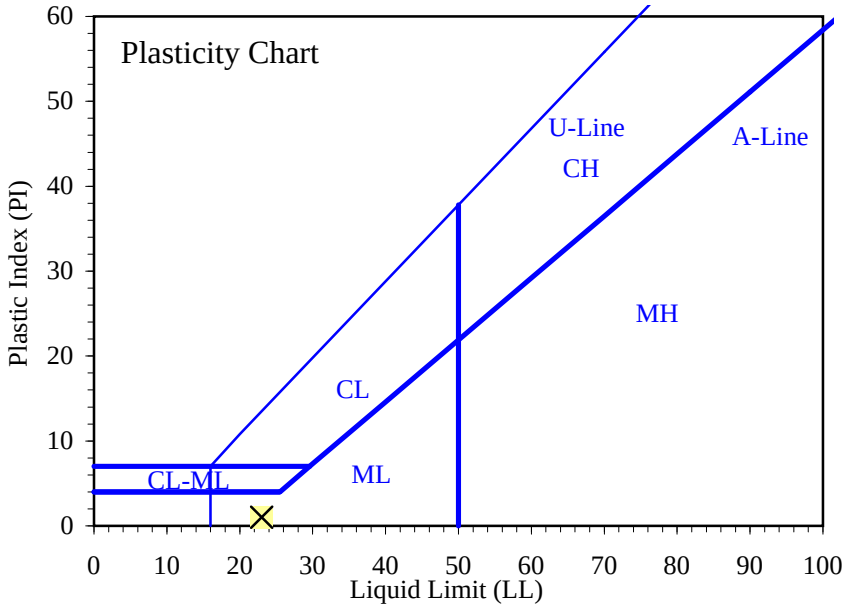
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 29.81 | 30.38 | | | | |
| Dry Soil + Tare (g) | 28.31 | 28.86 | | | | |
| Water Loss (g) | 1.50 | 1.52 | | | | |
| Tare (g) | 21.57 | 21.95 | | | | |
| Dry Soil (g) | 6.74 | 6.91 | | | | |
| Water Content, w (%) | 22.26 | 22.00 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 27 | 21 | 17 | | | |
| Wet Soil + Tare (g) | 31.03 | 30.86 | 31.60 | | | |
| Dry Soil + Tare (g) | 29.30 | 29.09 | 29.62 | | | |
| Water Loss (g) | 1.73 | 1.77 | 1.98 | | | |
| Tare (g) | 21.80 | 21.83 | 21.77 | | | |
| Dry Soil (g) | 7.50 | 7.26 | 7.85 | | | |
| Water Content, w (%) | 23.07 | 24.38 | 25.22 | | | |
| One-Point LL (%) | 23 | 24 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **23** |
| **Plastic Limit, PL (%)** | **22** |
| **Plasticity Index, PI (%)** | **1** |

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/12/2013
By: BRR

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

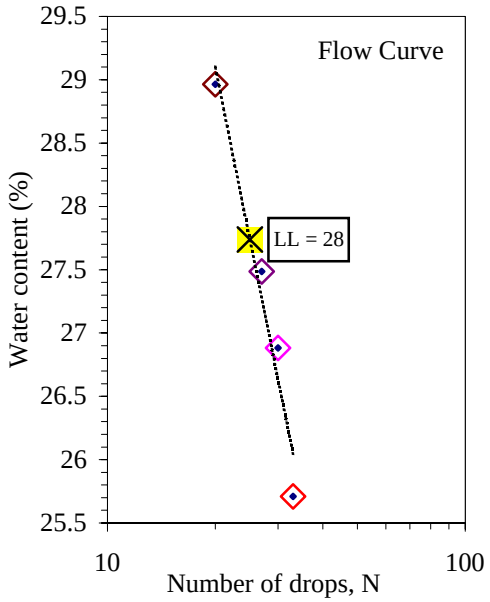
**Plastic Limit**

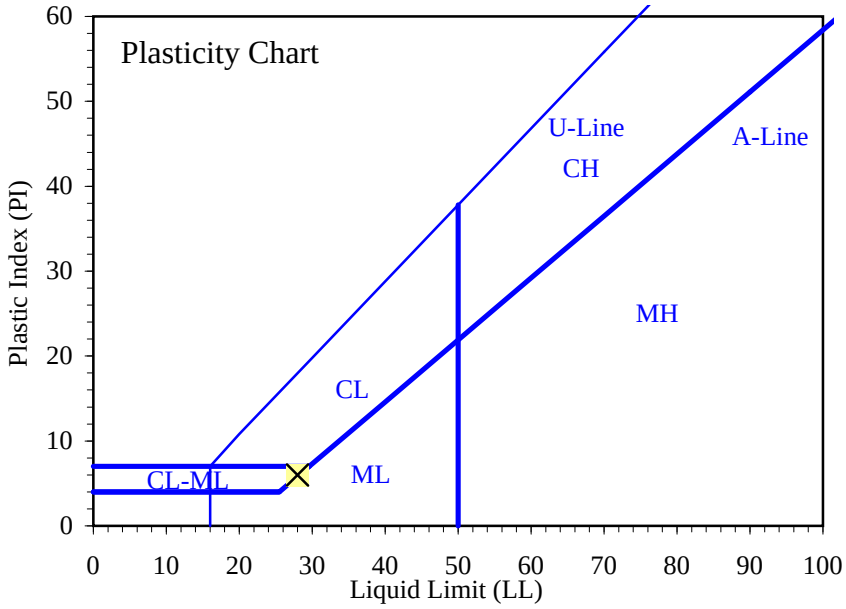
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 32.87 | 34.54 | | | | |
| Dry Soil + Tare (g) | 30.87 | 32.20 | | | | |
| Water Loss (g) | 2.00 | 2.34 | | | | |
| Tare (g) | 21.88 | 21.71 | | | | |
| Dry Soil (g) | 8.99 | 10.49 | | | | |
| Water Content, w (%) | 22.25 | 22.31 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | 4 | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 33 | 30 | 27 | 20 | | |
| Wet Soil + Tare (g) | 29.73 | 31.35 | 31.06 | 31.18 | | |
| Dry Soil + Tare (g) | 28.10 | 29.35 | 29.07 | 29.08 | | |
| Water Loss (g) | 1.63 | 2.00 | 1.99 | 2.10 | | |
| Tare (g) | 21.76 | 21.91 | 21.83 | 21.83 | | |
| Dry Soil (g) | 6.34 | 7.44 | 7.24 | 7.25 | | |
| Water Content, w (%) | 25.71 | 26.88 | 27.49 | 28.97 | | |
| One-Point LL (%) | | 27 | 28 | 28 | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **28** |
| **Plastic Limit, PL (%)** | **22** |
| **Plasticity Index, PI (%)** | **6** |




Entered by:_____
Reviewed:_____

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# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

**(ASTM D4318)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/12/2013
By: BRR

**Boring No.:** WUA-TP009-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

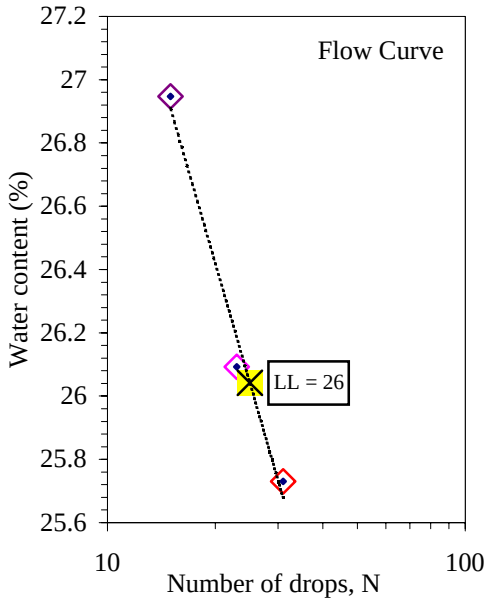
**Plastic Limit**

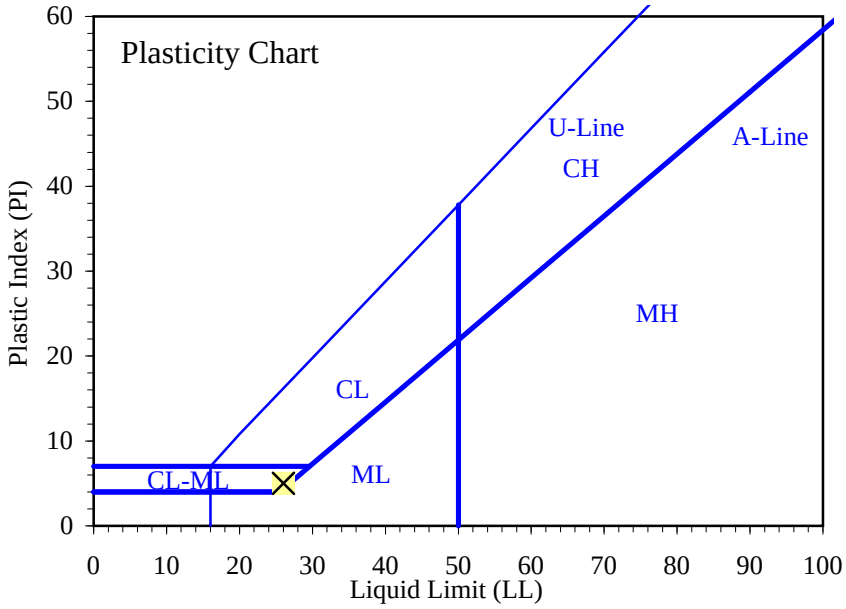
| Determination No | 1 | 2 | | | | |
|---|---|---|---|---|---|---|
| Wet Soil + Tare (g) | 31.58 | 32.40 | | | | |
| Dry Soil + Tare (g) | 29.88 | 30.55 | | | | |
| Water Loss (g) | 1.70 | 1.85 | | | | |
| Tare (g) | 21.85 | 21.71 | | | | |
| Dry Soil (g) | 8.03 | 8.84 | | | | |
| Water Content, w (%) | 21.17 | 20.93 | | | | |

**Liquid Limit**

| Determination No | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Number of Drops, N | 31 | 23 | 15 | | | |
| Wet Soil + Tare (g) | 30.83 | 31.90 | 32.25 | | | |
| Dry Soil + Tare (g) | 28.98 | 29.81 | 30.07 | | | |
| Water Loss (g) | 1.85 | 2.09 | 2.18 | | | |
| Tare (g) | 21.79 | 21.80 | 21.98 | | | |
| Dry Soil (g) | 7.19 | 8.01 | 8.09 | | | |
| Water Content, w (%) | 25.73 | 26.09 | 26.95 | | | |
| One-Point LL (%) | | 26 | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **26** |
| **Plastic Limit, PL (%)** | **21** |
| **Plasticity Index, PI (%)** | **5** |

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Liquid Limit, Plastic Limit, and Plasticity Index of Soils

**(ASTM D4318)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/14/2013
By: BRR

**Boring No.:** WUA-TP010-001
**Sample:**
**Depth:** 1-10'
Description: Brown silt

Preparation method: Air Dry
Liquid Limit: Could not be determined (N.P.)

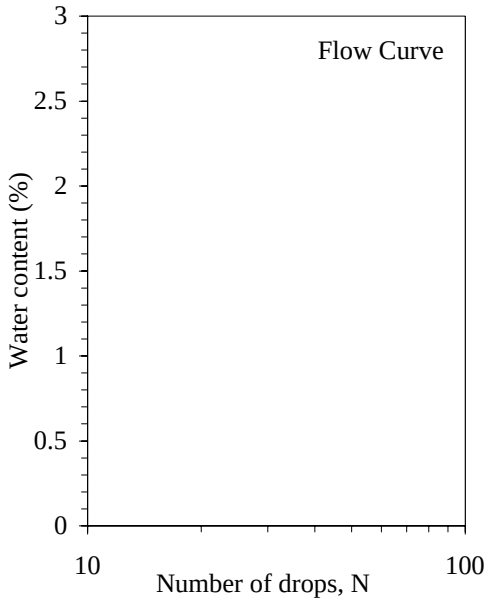
**Plastic Limit**

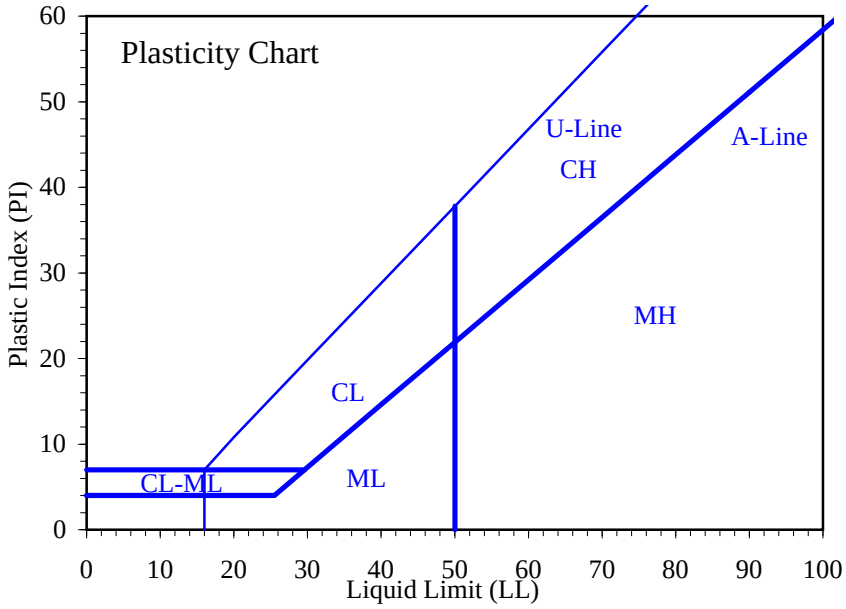
| | | | | | | |
|---|---|---|---|---|---|---|
| Determination No | | | | | | |
| Wet Soil + Tare (g) | | | | | | |
| Dry Soil + Tare (g) | | Difficult to thread. | | | | |
| Water Loss (g) | | | | | | |
| Tare (g) | | | | | | |
| Dry Soil (g) | | | | | | |
| Water Content, w (%) | | | | | | |

**Liquid Limit: Could not be determined (N.P.)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Determination No | | | | | | |
| Number of Drops, N | | | | | | |
| Wet Soil + Tare (g) | Unable to obtain an adequate blow count. | | | | | |
| Dry Soil + Tare (g) | | | | | | |
| Water Loss (g) | | | | | | |
| Tare (g) | | | | | | |
| Dry Soil (g) | | | | | | |
| Water Content, w (%) | | | | | | |
| One-Point LL (%) | | | | | | |

| | |
|---|---|
| **Liquid Limit, LL (%)** | **Nonplastic (N.P.)** |
| **Plastic Limit, PL (%)** | |
| **Plasticity Index, PI (%)** | |

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

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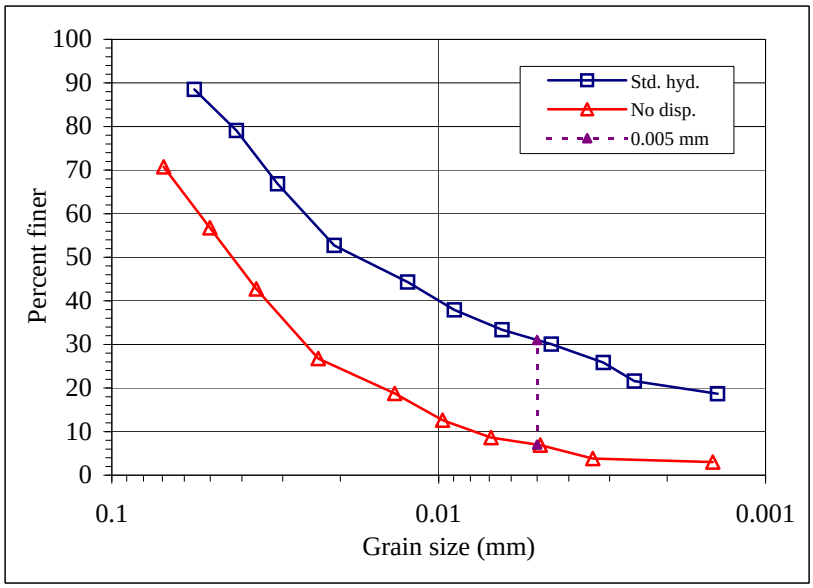
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 7.00 |
| Percent passing 5 um (ASTM D 422) = | 31.02 |
| **Percent Dispersion =** | **22.5** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0559 | 88.5 | | 0.0694 | 70.7 |
| 0.0415 | 79.1 | | 0.0501 | 56.7 |
| 0.0311 | 66.9 | | 0.0361 | 42.7 |
| 0.0209 | 52.7 | | 0.0234 | 26.7 |
| 0.0124 | 44.3 | | 0.0136 | 18.7 |
| 0.0090 | 37.9 | | 0.0097 | 12.6 |
| 0.0064 | 33.4 | | 0.0069 | 8.6 |
| 0.0045 | 30.1 | | 0.0049 | 6.9 |
| 0.0031 | 25.9 | | 0.0034 | 3.8 |
| 0.0025 | 21.6 | | 0.0014 | 3.0 |
| 0.0014 | 18.7 | | | |




Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

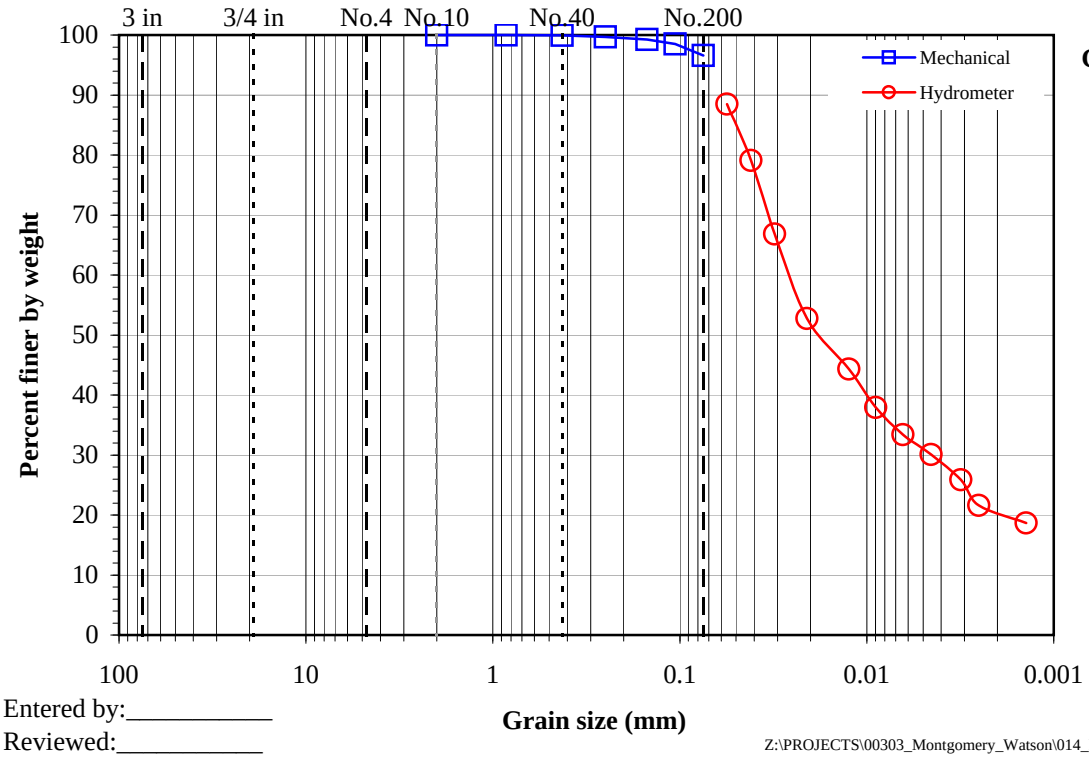
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 54.59 | 53.11 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 54.59 | 53.11 |
| Hydrometer fraction (g): | 54.59 | 53.11 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 92.41 | 92.41 |
| Dry soil + tare (g): | - | 90.93 | 90.93 |
| Tare (g): | - | 37.69 | 37.69 |
| Water content (%): | 0.00 | 2.78 | 2.78 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.01 | 0.85 | 100.0 | |
| No.40 | 0.03 | 0.425 | 99.9 | |
| No.60 | 0.18 | 0.25 | 99.7 | |
| No.100 | 0.39 | 0.15 | 99.3 | |
| No.140 | 0.78 | 0.106 | 98.5 | |
| No.200 | 1.80 | 0.075 | 96.6 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 17.7 | 51 | 0.05593 | 88.50 |
| 1 | 17.7 | 46 | 0.04154 | 79.09 |
| 2 | 17.7 | 39.5 | 0.03112 | 66.85 |
| 5 | 17.7 | 32 | 0.02088 | 52.73 |
| 15 | 17.8 | 27.5 | 0.01244 | 44.30 |
| 30 | 18.3 | 24 | 0.00895 | 37.92 |
| 60 | 18.7 | 21.5 | 0.00640 | 33.37 |
| 120 | 19.8 | 19.5 | 0.00452 | 30.06 |
| 250 | 21 | 17 | 0.00313 | 25.85 |
| 388 | 22.1 | 14.5 | 0.00252 | 21.60 |
| 1283 | 21.9 | 13 | 0.00140 | 18.69 |




**Gravel (%):** 0.0
**Sand (%):** 3.4
**Fines (%):** 96.6

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

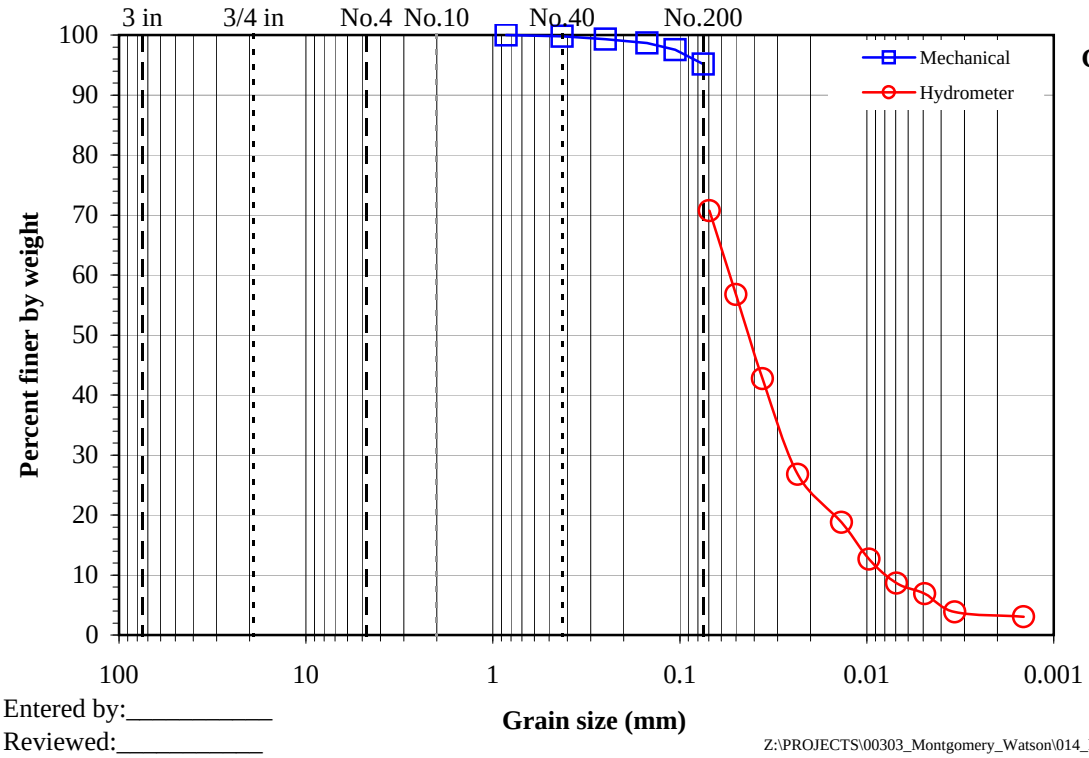
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 25.70 | 25.00 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 25.70 | 25.00 |
| Hydrometer fraction (g): | 25.70 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 92.41 | 92.41 |
| Dry soil + tare (g): | - | 90.93 | 90.93 |
| Tare (g): | - | 37.69 | 37.69 |
| Water content (%): | 0.00 | 2.78 | 2.78 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | - |
| 3/8" | - | 9.5 | - |
| No.4 | - | 4.75 | - |
| No.10 | - | 2 | - |
| No.20 | - | 0.85 | 100.0 |
| No.40 | 0.06 | 0.425 | 99.8 |
| No.60 | 0.17 | 0.25 | 99.3 |
| No.100 | 0.34 | 0.15 | 98.6 |
| No.140 | 0.62 | 0.106 | 97.5 |
| No.200 | 1.21 | 0.075 | 95.2 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 21.8 | 17 | 0.06941 | 70.74 |
| | 1 | 21.8 | 13.5 | 0.05011 | 56.74 |
| | 2 | 21.8 | 10 | 0.03615 | 42.74 |
| | 5 | 21.8 | 6 | 0.02337 | 26.75 |
| | 15 | 21.8 | 4 | 0.01364 | 18.75 |
| | 30 | 21.7 | 2.5 | 0.00973 | 12.62 |
| | 60 | 21.7 | 1.5 | 0.00692 | 8.62 |
| | 120 | 21.9 | 1 | 0.00489 | 6.89 |
| <=Split | 250 | 22.6 | 0 | 0.00338 | 3.82 |
| | 1377 | 22 | 0 | 0.00145 | 3.02 |




**Gravel (%):** 0.0
**Sand (%):** 4.8
**Fines (%):** 95.2

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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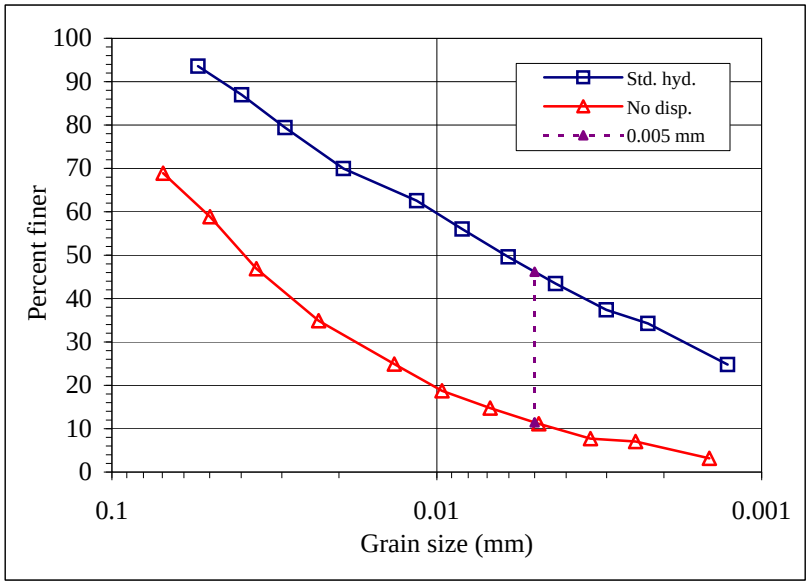
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP002-01
**Sample:**
**Depth:** 1-10'
Description: Brown clay

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 11.46 |
| Percent passing 5 um (ASTM D 422) = | 46.20 |
| **Percent Dispersion =** | **24.8** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0543 | 93.6 | | 0.0695 | 68.9 |
| 0.0399 | 87.0 | | 0.0499 | 58.9 |
| 0.0293 | 79.4 | | 0.0359 | 46.9 |
| 0.0194 | 70.0 | | 0.0231 | 34.9 |
| 0.0115 | 62.5 | | 0.0135 | 24.9 |
| 0.0084 | 56.0 | | 0.0096 | 18.8 |
| 0.0060 | 49.6 | | 0.0069 | 14.8 |
| 0.0043 | 43.5 | | 0.0049 | 11.2 |
| 0.0030 | 37.4 | | 0.0034 | 7.7 |
| 0.0022 | 34.3 | | 0.0024 | 7.0 |
| 0.0013 | 24.8 | | 0.0014 | 3.2 |




Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

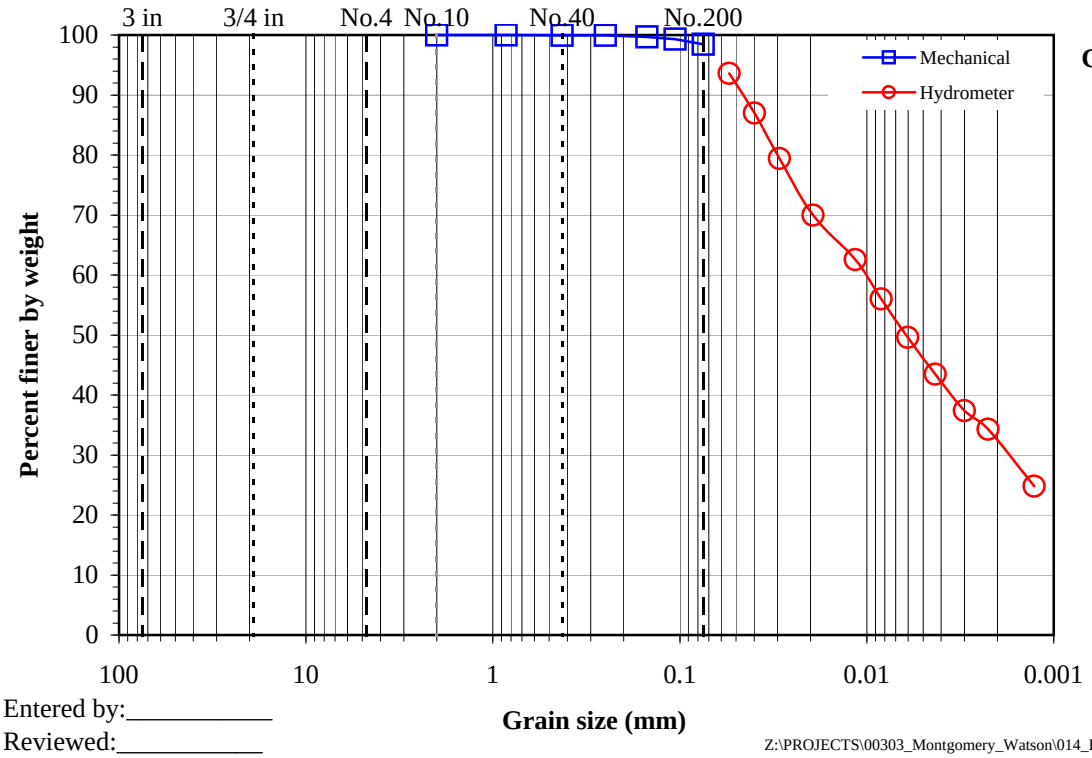
**Boring No.:** WUA-TP002-01
**Sample:**
**Depth:** 1-10'
Description: Brown clay

| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 54.81 | 52.95 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 54.81 | 52.95 |
| Hydrometer fraction (g): | 54.81 | 52.95 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 72.43 | 72.43 |
| Dry soil + tare (g): | - | 71.25 | 71.25 |
| Tare (g): | - | 37.74 | 37.74 |
| Water content (%): | 0.00 | 3.52 | 3.52 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|---|---|---|---|
| 8" | - | 200 | - | | 0.5 | 17.9 | 53.5 | 0.05434 | 93.59 |
| 6" | - | 150 | - | | 1 | 17.9 | 50 | 0.03986 | 86.98 |
| 4" | - | 100 | - | | 2 | 17.9 | 46 | 0.02931 | 79.42 |
| 3" | - | 75 | - | | 5 | 17.9 | 41 | 0.01938 | 69.98 |
| 1.5" | - | 37.5 | - | | 15 | 18.2 | 37 | 0.01153 | 62.55 |
| 3/4" | - | 19 | - | | 30 | 18.4 | 33.5 | 0.00836 | 56.02 |
| 3/8" | - | 9.5 | - | | 60 | 18.9 | 30 | 0.00603 | 49.62 |
| No.4 | - | 4.75 | - | | 120 | 20 | 26.5 | 0.00431 | 43.46 |
| No.10 | - | 2 | 100.0 | <=Split | 250 | 21.3 | 23 | 0.00301 | 37.39 |
| No.20 | 0.01 | 0.85 | 100.0 | | 445 | 22.9 | 21 | 0.00224 | 34.27 |
| No.40 | 0.02 | 0.425 | 100.0 | | 1469 | 22.8 | 16 | 0.00127 | 24.79 |
| No.60 | 0.04 | 0.25 | 99.9 | | | | | | |
| No.100 | 0.17 | 0.15 | 99.7 | | | | | | |
| No.140 | 0.38 | 0.106 | 99.3 | | | | | | |
| No.200 | 0.83 | 0.075 | 98.4 | | | | | | |




**Gravel (%):** 0.0
**Sand (%):** 1.6
**Fines (%):** 98.4

Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP002-01
**Sample:**
**Depth:** 1-10'
Description: Brown clay

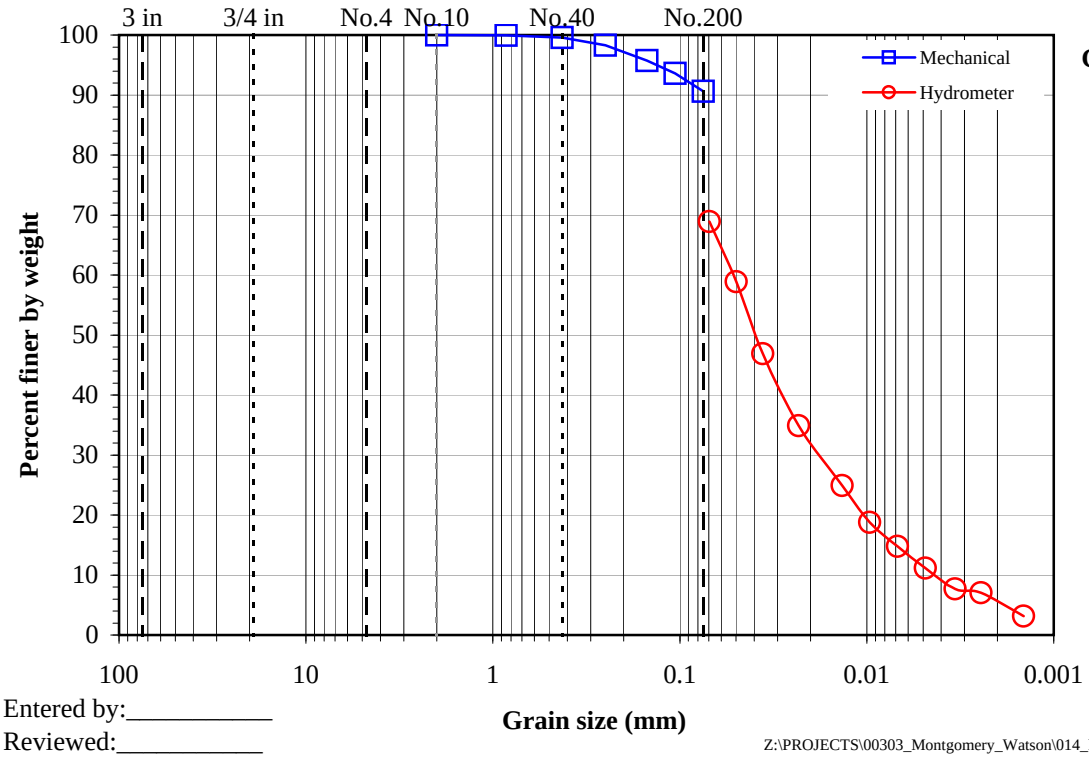
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 25.88 | 25.00 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 25.88 | 25.00 |
| Hydrometer fraction (g): | 25.88 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 72.43 | 72.43 |
| Dry soil + tare (g): | - | 71.25 | 71.25 |
| Tare (g): | - | 37.74 | 37.74 |
| Water content (%): | 0.00 | 3.52 | 3.52 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.01 | 0.85 | 100.0 | |
| No.40 | 0.10 | 0.425 | 99.6 | |
| No.60 | 0.43 | 0.25 | 98.3 | |
| No.100 | 1.06 | 0.15 | 95.8 | |
| No.140 | 1.60 | 0.106 | 93.6 | |
| No.200 | 2.34 | 0.075 | 90.6 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 21.9 | 16.5 | 0.06955 | 68.89 |
| 1 | 21.9 | 14 | 0.04991 | 58.89 |
| 2 | 21.9 | 11 | 0.03591 | 46.89 |
| 5 | 21.9 | 8 | 0.02309 | 34.89 |
| 15 | 21.9 | 5.5 | 0.01351 | 24.89 |
| 30 | 21.8 | 4 | 0.00964 | 18.75 |
| 60 | 21.8 | 3 | 0.00685 | 14.75 |
| 120 | 22.1 | 2 | 0.00485 | 11.15 |
| 250 | 22.5 | 1 | 0.00336 | 7.69 |
| 465 | 23.5 | 0.5 | 0.00244 | 7.03 |
| 1375 | 22.1 | 0 | 0.00145 | 3.15 |




**Gravel (%):** 0.0
**Sand (%):** 9.4
**Fines (%):** 90.6

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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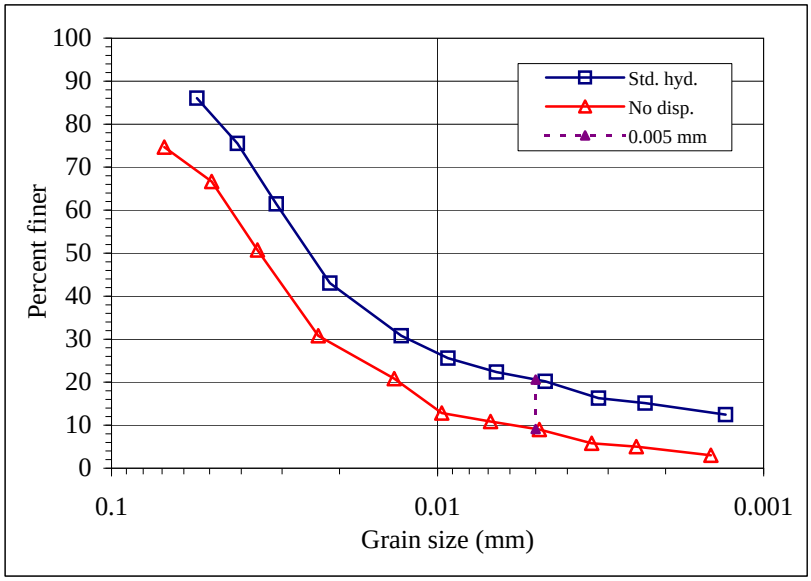
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP003-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 9.13 |
| Percent passing 5 um (ASTM D 422) = | 20.62 |
| **Percent Dispersion =** | **44.3** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0547 | 86.0 | | 0.0689 | 74.7 |
| 0.0411 | 75.5 | | 0.0493 | 66.7 |
| 0.0312 | 61.5 | | 0.0357 | 50.7 |
| 0.0214 | 43.0 | | 0.0232 | 30.8 |
| 0.0129 | 30.8 | | 0.0136 | 20.8 |
| 0.0093 | 25.6 | | 0.0097 | 12.8 |
| 0.0066 | 22.4 | | 0.0069 | 10.9 |
| 0.0047 | 20.2 | | 0.0049 | 9.0 |
| 0.0032 | 16.3 | | 0.0034 | 5.8 |
| 0.0023 | 15.1 | | 0.0025 | 5.0 |
| 0.0013 | 12.5 | | 0.0015 | 3.0 |




Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

IGES

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP003-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

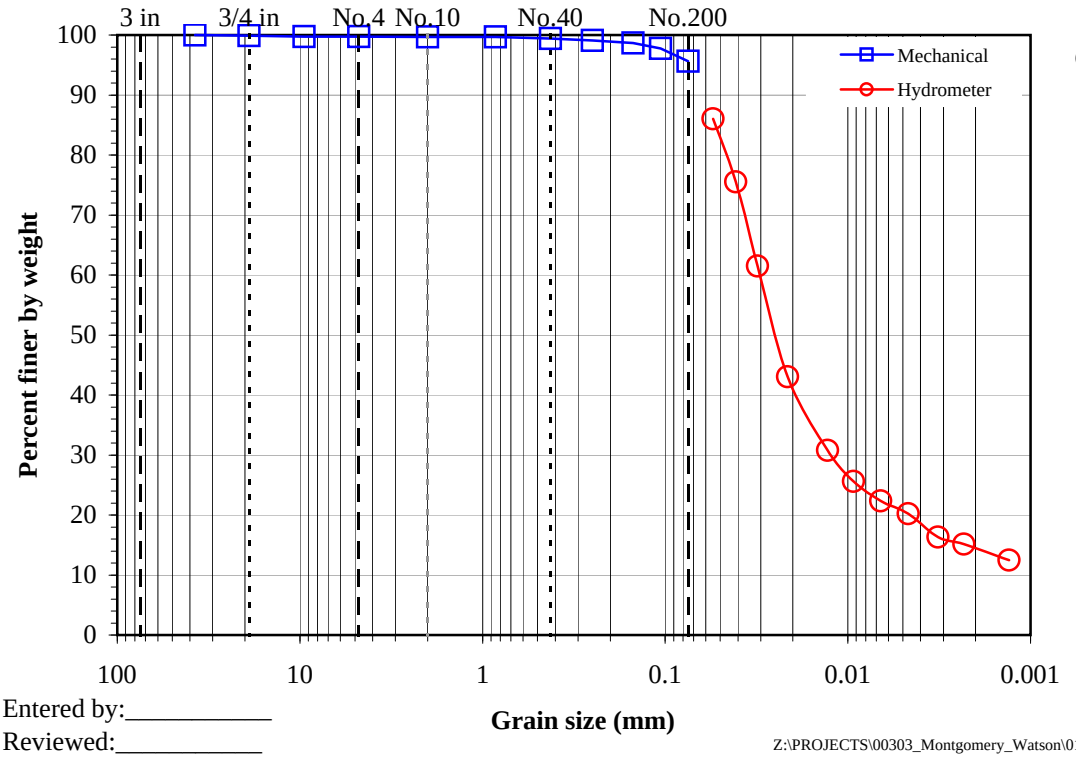
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | 3/8" | |
| | Moist | Dry |
| Total sample wt. (g): | 18843.42 | 17743.34 |
| +3/8" Coarse fraction (g): | 51.32 | 51.10 |
| -3/8" Split fraction (g): | 463.00 | 463.00 |
| Hydrometer fraction (g): | 57.65 | 56.82 |
| Split fraction: | 0.997 | |

| Water content data | C.F.(+3/8") | S.F.(-3/8") | Hyd.(+No.10) | Hyd.(-No.10) |
|---|---|---|---|---|
| Moist soil + tare (g): | 178.88 | 626.37 | 37.82 | 72.08 |
| Dry soil + tare (g): | 178.66 | 597.15 | 37.82 | 71.58 |
| Tare (g): | 127.16 | 127.12 | 37.77 | 37.47 |
| Water content (%): | 0.43 | 6.22 | 0.00 | 1.47 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 99.70 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | 100.0 |
| 3/4" | 21.15 | 19 | 99.9 |
| 3/8" | 51.10 | 9.5 | 99.7 |
| No.4 | - | 4.75 | 99.7 |
| No.10 | 0.05 | 2 | 99.7 |
| No.20 | 0.02 | 0.85 | 99.7 |
| No.40 | 0.15 | 0.425 | 99.4 |
| No.60 | 0.34 | 0.25 | 99.1 |
| No.100 | 0.60 | 0.15 | 98.6 |
| No.140 | 1.12 | 0.106 | 97.7 |
| No.200 | 2.32 | 0.075 | 95.6 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 17.8 | 53 | 0.05471 | 86.04 |
| | 1 | 17.8 | 47 | 0.04111 | 75.51 |
| | 2 | 17.8 | 39 | 0.03122 | 61.47 |
| | 5 | 17.8 | 28.5 | 0.02139 | 43.04 |
| | 15 | 17.9 | 21.5 | 0.01293 | 30.80 |
| | 30 | 18.1 | 18.5 | 0.00929 | 25.61 |
| <=Split | 60 | 18.8 | 16.5 | 0.00660 | 22.37 |
| | 118 | 20 | 15 | 0.00467 | 20.20 |
| <=Split hyd. | 250 | 21.3 | 12.5 | 0.00321 | 16.31 |
| | 470 | 22.8 | 11.5 | 0.00231 | 15.13 |
| | 1494 | 22.7 | 10 | 0.00131 | 12.46 |




**Gravel (%):** 0.3
**Sand (%):** 4.1
**Fines (%):** 95.6

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP003-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

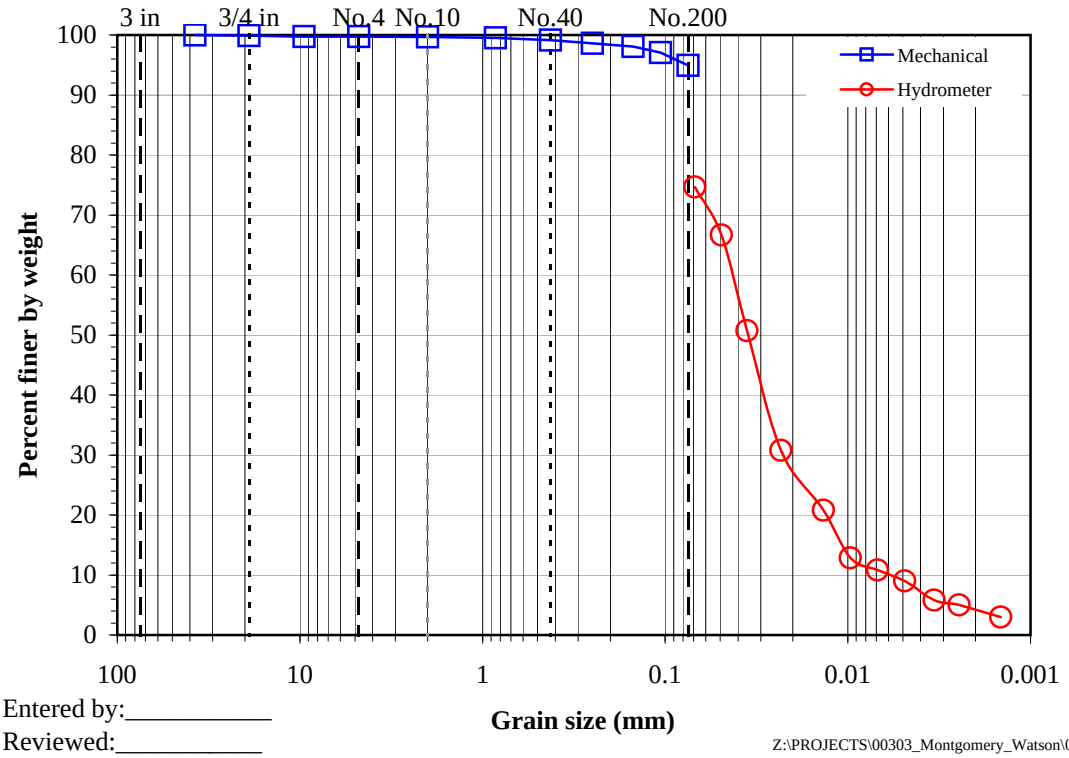
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | 3/8" | |
| | Moist | Dry |
| Total sample wt. (g): | 18843.42 | 17743.34 |
| +3/8" Coarse fraction (g): | 51.32 | 51.10 |
| -3/8" Split fraction (g): | 463.00 | 463.00 |
| Hydrometer fraction (g): | 25.37 | 25.00 |
| Split fraction: | 0.997 | |

| Water content data | C.F.(+3/8") | S.F.(-3/8") | Hyd.(+No.10) | Hyd.(-No.10) |
|---|---|---|---|---|
| Moist soil + tare (g): | 178.88 | 626.37 | 37.82 | 72.08 |
| Dry soil + tare (g): | 178.66 | 597.15 | 37.82 | 71.58 |
| Tare (g): | 127.16 | 127.12 | 37.77 | 37.47 |
| Water content (%): | 0.43 | 6.22 | 0.00 | 1.47 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 99.70 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | 100.0 |
| 3/4" | 21.15 | 19 | 99.9 |
| 3/8" | 51.10 | 9.5 | 99.7 |
| No.4 | - | 4.75 | 99.7 |
| No.10 | 0.05 | 2 | 99.7 |
| No.20 | 0.04 | 0.85 | 99.5 |
| No.40 | 0.14 | 0.425 | 99.1 |
| No.60 | 0.27 | 0.25 | 98.6 |
| No.100 | 0.40 | 0.15 | 98.1 |
| No.140 | 0.66 | 0.106 | 97.1 |
| No.200 | 1.19 | 0.075 | 95.0 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 21.9 | 18 | 0.06891 | 74.65 |
| | 1 | 21.9 | 16 | 0.04933 | 66.68 |
| | 2 | 21.9 | 12 | 0.03571 | 50.73 |
| | 5 | 21.9 | 7 | 0.02322 | 30.79 |
| | 15 | 21.9 | 4.5 | 0.01359 | 20.82 |
| | 30 | 21.9 | 2.5 | 0.00971 | 12.85 |
| <=Split | 60 | 21.9 | 2 | 0.00688 | 10.85 |
| | 120 | 22 | 1.5 | 0.00487 | 8.99 |
| <=Split hyd. | 250 | 22.6 | 0.5 | 0.00337 | 5.81 |
| | 462 | 23.5 | 0 | 0.00246 | 5.02 |
| | 1372 | 22 | 0 | 0.00145 | 3.01 |




**Gravel (%):** 0.3
**Sand (%):** 4.8
**Fines (%):** 95.0

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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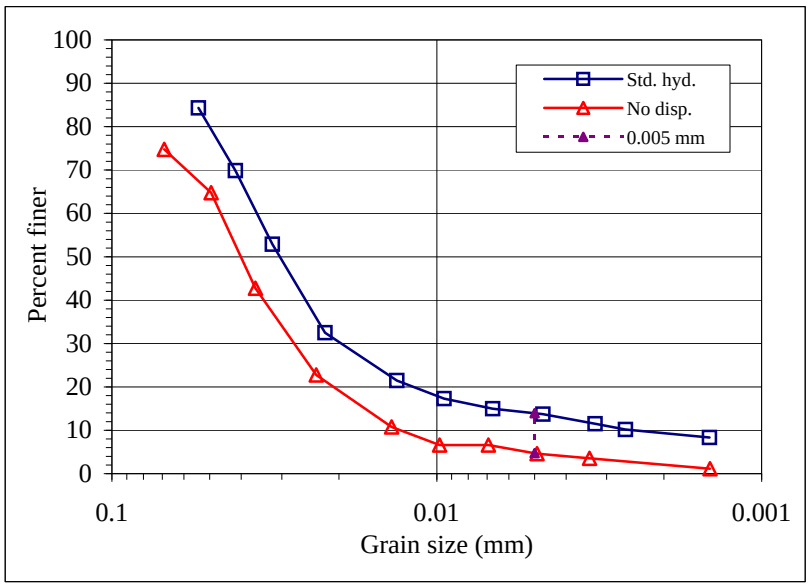
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 4.72 |
| Percent passing 5 um (ASTM D 422) = | 13.93 |
| **Percent Dispersion =** | **33.9** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0541 | 84.3 | | 0.0690 | 74.8 |
| 0.0417 | 69.9 | | 0.0495 | 64.8 |
| 0.0321 | 52.9 | | 0.0361 | 42.8 |
| 0.0221 | 32.5 | | 0.0235 | 22.8 |
| 0.0133 | 21.5 | | 0.0138 | 10.8 |
| 0.0095 | 17.3 | | 0.0098 | 6.6 |
| 0.0067 | 15.0 | | 0.0069 | 6.6 |
| 0.0047 | 13.7 | | 0.0049 | 4.6 |
| 0.0033 | 11.5 | | 0.0034 | 3.6 |
| 0.0026 | 10.2 | | 0.0014 | 1.1 |
| 0.0014 | 8.3 | | | |




Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

IGES

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

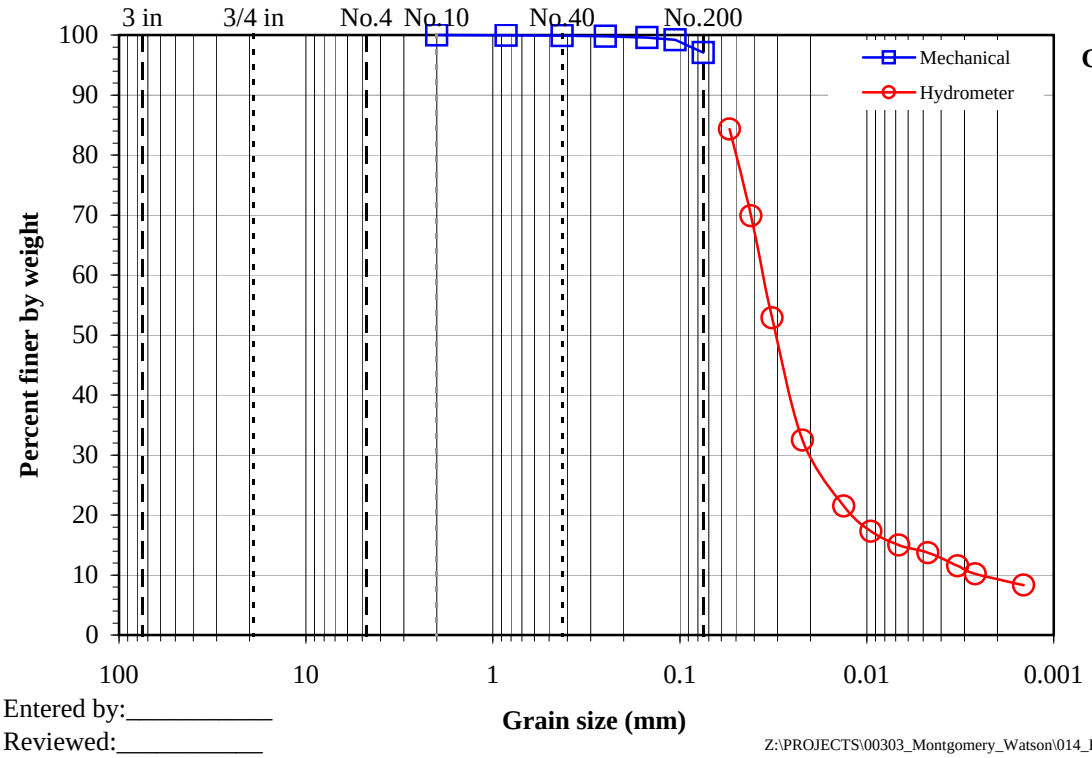
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 59.44 | 58.85 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 59.44 | 58.85 |
| Hydrometer fraction (g): | 59.44 | 58.85 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 48.39 | 48.39 |
| Dry soil + tare (g): | - | 48.28 | 48.28 |
| Tare (g): | - | 37.39 | 37.39 |
| Water content (%): | 0.00 | 1.01 | 1.01 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.02 | 0.85 | 100.0 | |
| No.40 | 0.05 | 0.425 | 99.9 | |
| No.60 | 0.13 | 0.25 | 99.8 | |
| No.100 | 0.24 | 0.15 | 99.6 | |
| No.140 | 0.48 | 0.106 | 99.2 | |
| No.200 | 1.73 | 0.075 | 97.1 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 18.2 | 53.5 | 0.05413 | 84.32 |
| 1 | 18.2 | 45 | 0.04167 | 69.87 |
| 2 | 18.2 | 35 | 0.03207 | 52.88 |
| 5 | 18.2 | 23 | 0.02209 | 32.49 |
| 15 | 18.3 | 16.5 | 0.01327 | 21.48 |
| 30 | 18.5 | 14 | 0.00950 | 17.30 |
| 60 | 19.1 | 12.5 | 0.00673 | 14.98 |
| 120 | 20.3 | 11.5 | 0.00471 | 13.73 |
| 250 | 21.2 | 10 | 0.00326 | 11.51 |
| 380 | 22.2 | 9 | 0.00262 | 10.18 |
| 1275 | 21.8 | 8 | 0.00145 | 8.34 |




**Gravel (%):** 0.0
**Sand (%):** 2.9
**Fines (%):** 97.1

Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

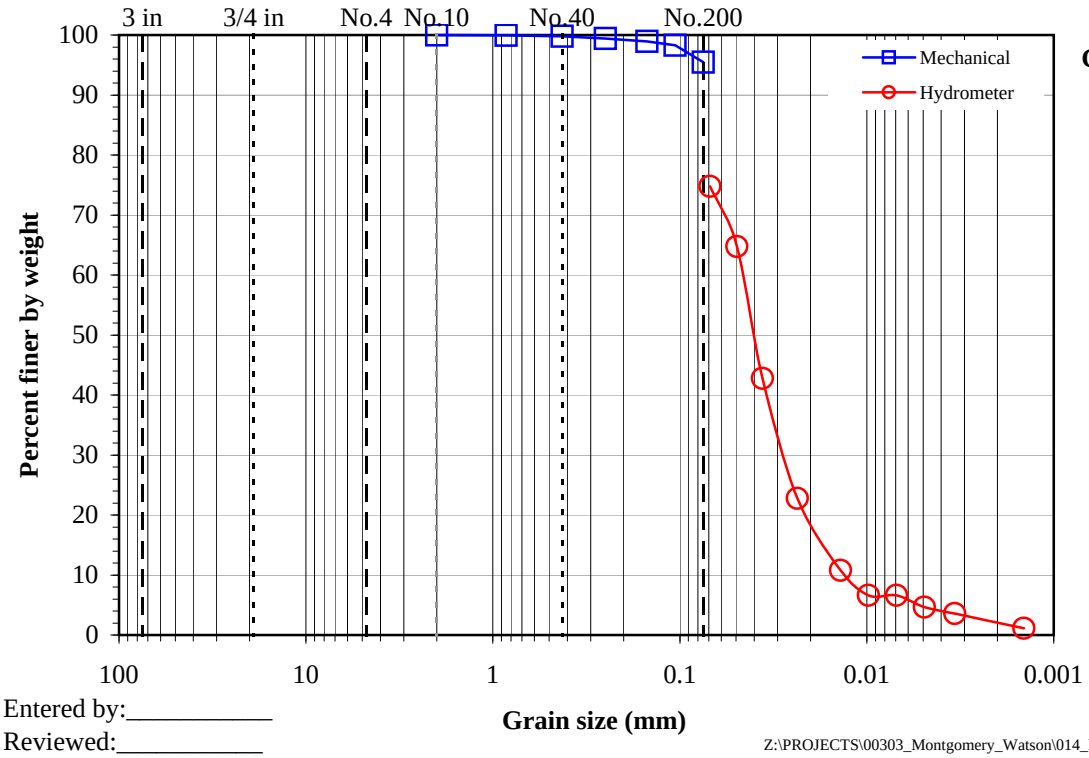
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 25.25 | 25.00 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 25.25 | 25.00 |
| Hydrometer fraction (g): | 25.25 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 48.39 | 48.39 |
| Dry soil + tare (g): | - | 48.28 | 48.28 |
| Tare (g): | - | 37.39 | 37.39 |
| Water content (%): | 0.00 | 1.01 | 1.01 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.01 | 0.85 | 100.0 | |
| No.40 | 0.05 | 0.425 | 99.8 | |
| No.60 | 0.14 | 0.25 | 99.4 | |
| No.100 | 0.27 | 0.15 | 98.9 | |
| No.140 | 0.43 | 0.106 | 98.3 | |
| No.200 | 1.13 | 0.075 | 95.5 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 21.8 | 18 | 0.06899 | 74.76 |
| 1 | 21.8 | 15.5 | 0.04952 | 64.76 |
| 2 | 21.8 | 10 | 0.03615 | 42.76 |
| 5 | 21.8 | 5 | 0.02349 | 22.75 |
| 15 | 21.8 | 2 | 0.01378 | 10.75 |
| 30 | 21.7 | 1 | 0.00981 | 6.62 |
| 60 | 21.7 | 1 | 0.00694 | 6.62 |
| 120 | 21.7 | 0.5 | 0.00492 | 4.62 |
| 250 | 22.4 | 0 | 0.00339 | 3.56 |
| 1440 | 20.6 | 0 | 0.00144 | 1.14 |




**Gravel (%):** 0.0
**Sand (%):** 4.5
**Fines (%):** 95.5

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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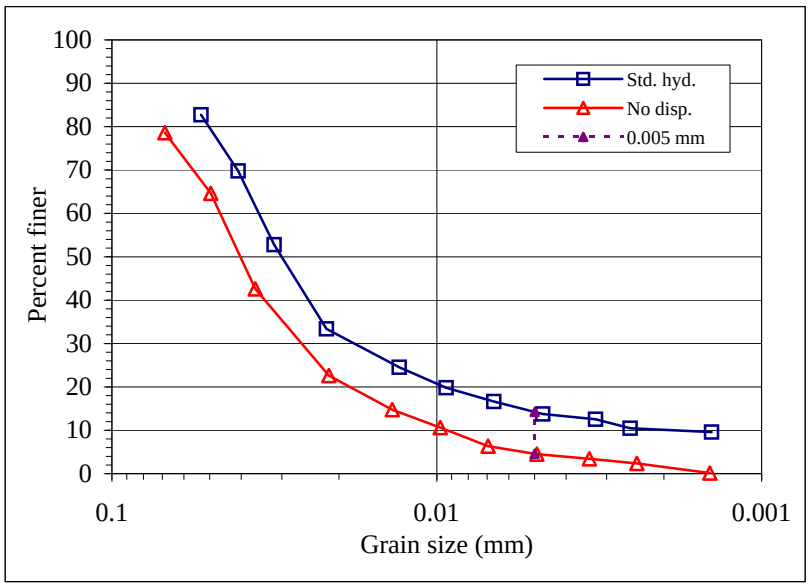
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP005-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 4.57 |
| Percent passing 5 um (ASTM D 422) = | 14.25 |
| **Percent Dispersion =** | **32.1** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0532 | 82.7 | | 0.0687 | 78.6 |
| 0.0409 | 69.8 | | 0.0496 | 64.6 |
| 0.0317 | 52.8 | | 0.0362 | 42.6 |
| 0.0219 | 33.4 | | 0.0215 | 22.6 |
| 0.0131 | 24.5 | | 0.0137 | 14.8 |
| 0.0094 | 19.8 | | 0.0098 | 10.6 |
| 0.0067 | 16.7 | | 0.0069 | 6.4 |
| 0.0047 | 13.8 | | 0.0049 | 4.5 |
| 0.0032 | 12.5 | | 0.0034 | 3.4 |
| 0.0025 | 10.5 | | 0.0024 | 2.4 |
| 0.0014 | 9.6 | | 0.0014 | 0.1 |




Entered by:_____
Reviewed:_____

Z:\PROJECTS\00303_Montgomery_Watson\014_FMC_Pocatello\[GSD+hyd_double.xls]Summary

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP005-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

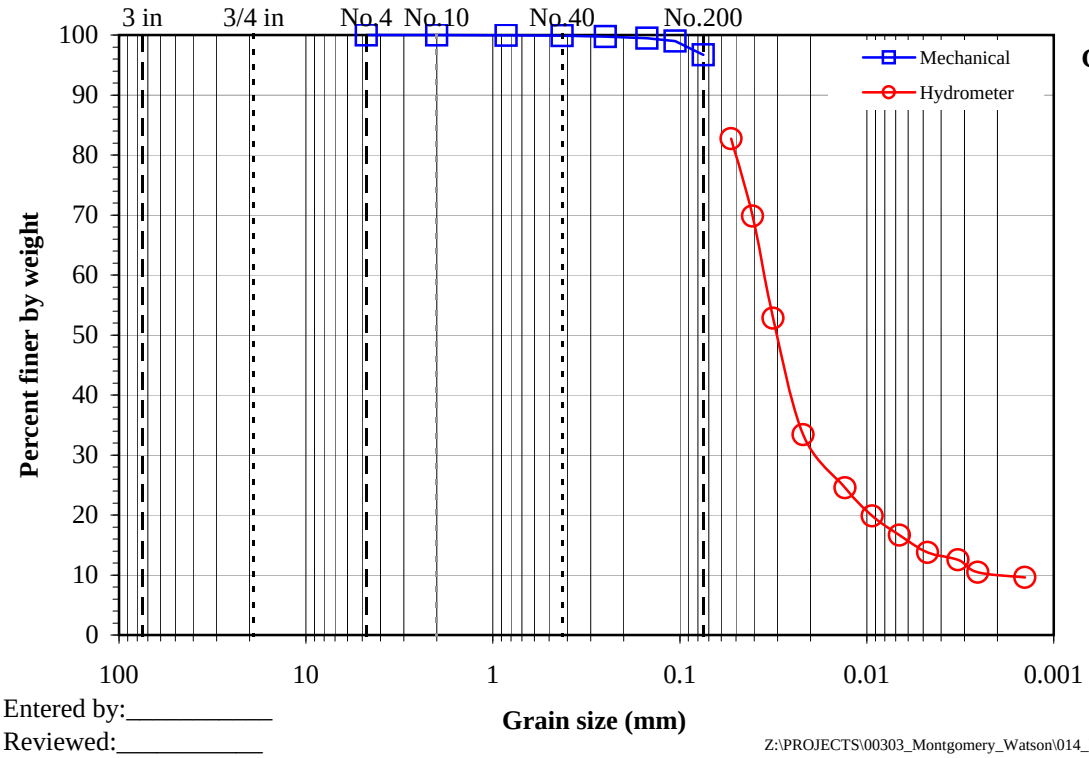
| | Moist | Dry |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| Total sample wt. (g): | 563.63 | 556.09 |
| +#10 Coarse fraction (g): | 0.01 | 0.01 |
| -#10 Split fraction (g): | 62.65 | 61.81 |
| Hydrometer fraction (g): | 62.65 | 61.81 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | 37.86 | 120.67 | 120.67 |
| Dry soil + tare (g): | 37.86 | 119.56 | 119.56 |
| Tare (g): | 37.84 | 37.75 | 37.75 |
| Water content (%): | 0.00 | 1.36 | 1.36 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | 100.0 | |
| No.10 | 0.01 | 2 | 100.0 | <=Split |
| No.20 | 0.03 | 0.85 | 99.9 | |
| No.40 | 0.08 | 0.425 | 99.9 | |
| No.60 | 0.17 | 0.25 | 99.7 | |
| No.100 | 0.32 | 0.15 | 99.5 | |
| No.140 | 0.61 | 0.106 | 99.0 | |
| No.200 | 2.03 | 0.075 | 96.7 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 18.3 | 55 | 0.05319 | 82.73 |
| 1 | 18.3 | 47 | 0.04086 | 69.79 |
| 2 | 18.3 | 36.5 | 0.03166 | 52.80 |
| 5 | 18.3 | 24.5 | 0.02185 | 33.39 |
| 15 | 18.4 | 19 | 0.01305 | 24.53 |
| 30 | 18.8 | 16 | 0.00936 | 19.82 |
| 60 | 19 | 14 | 0.00668 | 16.65 |
| 120 | 20 | 12 | 0.00472 | 13.77 |
| 250 | 21.1 | 11 | 0.00324 | 12.54 |
| 404 | 22.1 | 9.5 | 0.00254 | 10.47 |
| 1297 | 21.9 | 9 | 0.00143 | 9.59 |




**Gravel (%):** 0.0
**Sand (%):** 3.3
**Fines (%):** 96.7

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP005-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

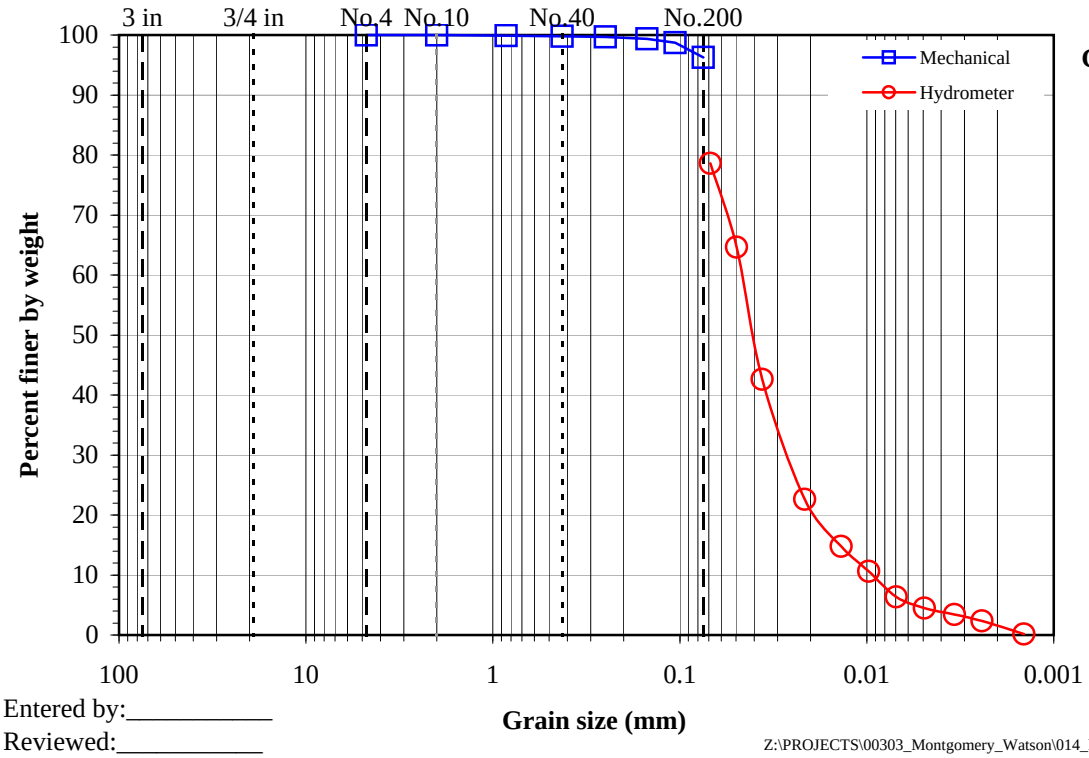
| | Moist | Dry |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| Total sample wt. (g): | 563.63 | 556.09 |
| +#10 Coarse fraction (g): | 0.01 | 0.01 |
| -#10 Split fraction (g): | 25.34 | 25.00 |
| Hydrometer fraction (g): | 25.34 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | 37.86 | 120.67 | 120.67 |
| Dry soil + tare (g): | 37.86 | 119.56 | 119.56 |
| Tare (g): | 37.84 | 37.75 | 37.75 |
| Water content (%): | 0.00 | 1.36 | 1.36 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | - |
| 3/8" | - | 9.5 | - |
| No.4 | - | 4.75 | 100.0 |
| No.10 | 0.01 | 2 | 100.0 |
| No.20 | 0.02 | 0.85 | 99.9 |
| No.40 | 0.05 | 0.425 | 99.8 |
| No.60 | 0.08 | 0.25 | 99.7 |
| No.100 | 0.16 | 0.15 | 99.4 |
| No.140 | 0.32 | 0.106 | 98.7 |
| No.200 | 0.93 | 0.075 | 96.3 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 21.7 | 19 | 0.06867 | 78.61 |
| | 1 | 21.7 | 15.5 | 0.04960 | 64.62 |
| | 2 | 21.7 | 10 | 0.03621 | 42.62 |
| | 6 | 21.7 | 5 | 0.02148 | 22.62 |
| | 15 | 21.8 | 3 | 0.01371 | 14.75 |
| | 30 | 21.7 | 2 | 0.00976 | 10.62 |
| | 60 | 21.5 | 1 | 0.00695 | 6.35 |
| | 120 | 21.6 | 0.5 | 0.00492 | 4.48 |
| <=Split | 250 | 22.3 | 0 | 0.00339 | 3.42 |
| | 484 | 23 | -0.5 | 0.00242 | 2.36 |
| | 1440 | 20.6 | -0.25 | 0.00144 | 0.14 |




**Gravel (%):** 0.0
**Sand (%):** 3.7
**Fines (%):** 96.3

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

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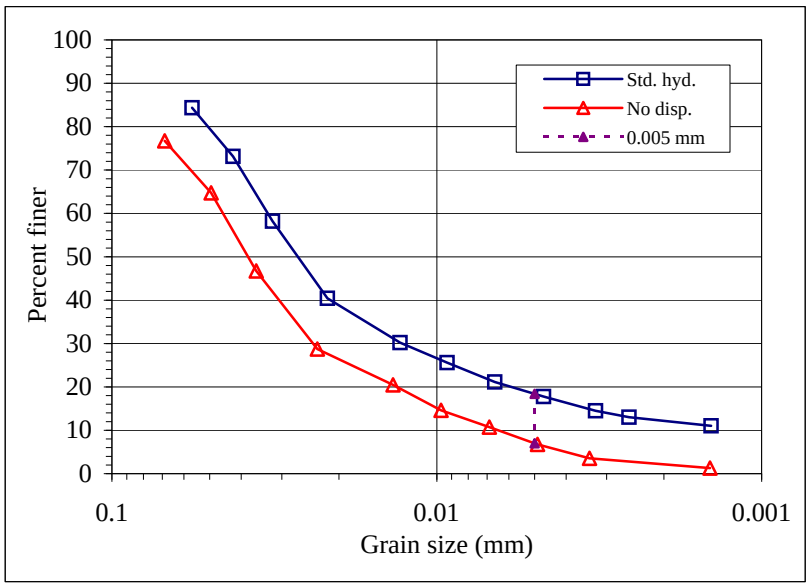
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 7.00 |
| Percent passing 5 um (ASTM D 422) = | 18.40 |
| **Percent Dispersion =** | **38.0** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0567 | 84.4 | | 0.0688 | 76.7 |
| 0.0424 | 73.2 | | 0.0495 | 64.7 |
| 0.0320 | 58.2 | | 0.0359 | 46.7 |
| 0.0217 | 40.4 | | 0.0233 | 28.7 |
| 0.0130 | 30.2 | | 0.0136 | 20.5 |
| 0.0093 | 25.6 | | 0.0097 | 14.6 |
| 0.0066 | 21.1 | | 0.0069 | 10.8 |
| 0.0047 | 17.8 | | 0.0049 | 6.8 |
| 0.0032 | 14.5 | | 0.0034 | 3.6 |
| 0.0026 | 13.0 | | 0.0014 | 1.3 |
| 0.0014 | 11.0 | | | |




Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

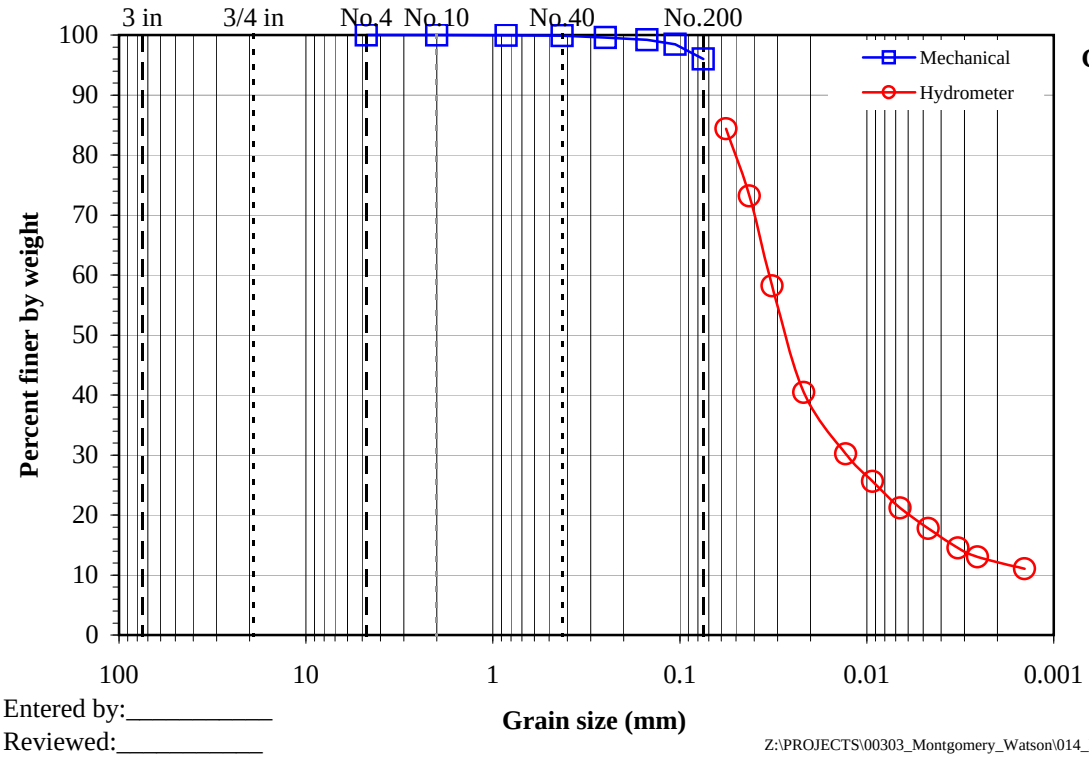
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 575.27 | 551.95 |
| +#10 Coarse fraction (g): | 0.01 | 0.01 |
| -#10 Split fraction (g): | 55.76 | 53.50 |
| Hydrometer fraction (g): | 55.76 | 53.50 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | 37.60 | 102.43 | 102.43 |
| Dry soil + tare (g): | 37.60 | 99.79 | 99.79 |
| Tare (g): | 37.57 | 37.31 | 37.31 |
| Water content (%): | 0.00 | 4.23 | 4.23 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | 100.0 | |
| No.10 | 0.01 | 2 | 100.0 | <=Split |
| No.20 | 0.02 | 0.85 | 100.0 | |
| No.40 | 0.06 | 0.425 | 99.9 | |
| No.60 | 0.22 | 0.25 | 99.6 | |
| No.100 | 0.44 | 0.15 | 99.2 | |
| No.140 | 0.82 | 0.106 | 98.5 | |
| No.200 | 2.13 | 0.075 | 96.0 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 18.3 | 49 | 0.05667 | 84.37 |
| 1 | 18.3 | 43 | 0.04239 | 73.16 |
| 2 | 18.3 | 35 | 0.03204 | 58.20 |
| 5 | 18.3 | 25.5 | 0.02171 | 40.45 |
| 15 | 18.4 | 20 | 0.01297 | 30.21 |
| 30 | 18.6 | 17.5 | 0.00929 | 25.62 |
| 60 | 19.1 | 15 | 0.00663 | 21.15 |
| 120 | 20 | 13 | 0.00469 | 17.78 |
| 250 | 21.1 | 11 | 0.00324 | 14.49 |
| 396 | 22.1 | 10 | 0.00256 | 13.03 |
| 1290 | 21.8 | 9 | 0.00143 | 11.04 |




**Gravel (%):** 0.0
**Sand (%):** 4.0
**Fines (%):** 96.0

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

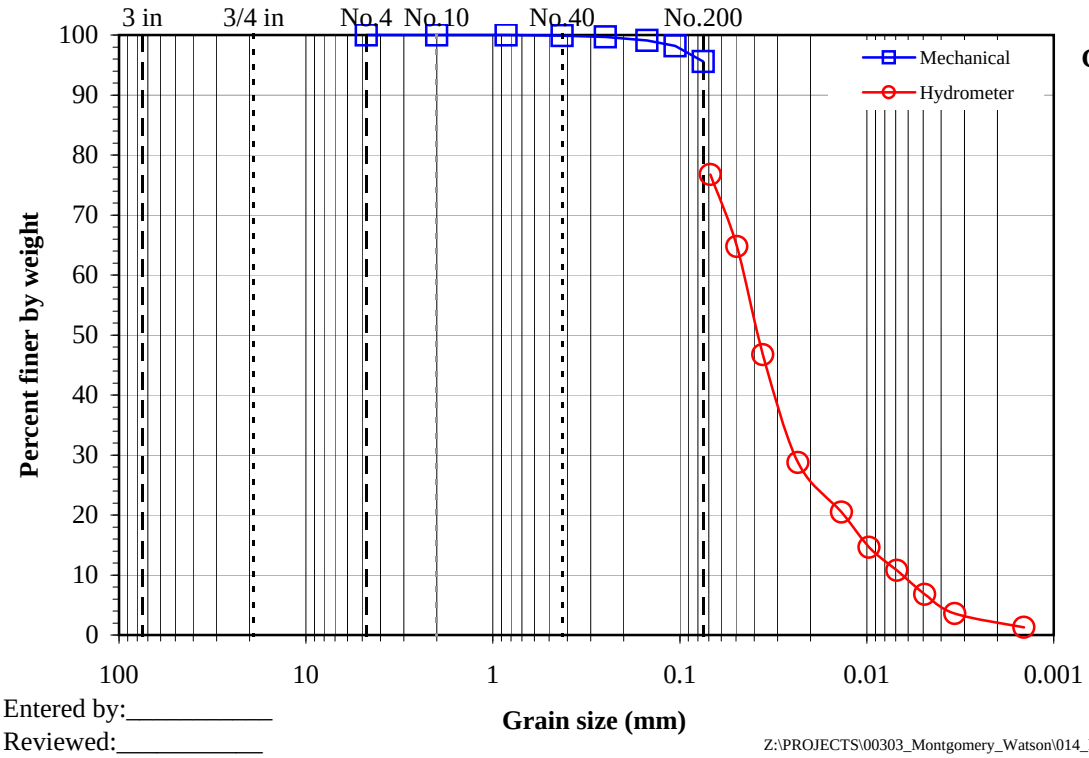
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 575.27 | 551.95 |
| +#10 Coarse fraction (g): | 0.01 | 0.01 |
| -#10 Split fraction (g): | 26.06 | 25.00 |
| Hydrometer fraction (g): | 26.06 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | 37.60 | 102.43 | 102.43 |
| Dry soil + tare (g): | 37.60 | 99.79 | 99.79 |
| Tare (g): | 37.57 | 37.31 | 37.31 |
| Water content (%): | 0.00 | 4.23 | 4.23 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | - |
| 3/8" | - | 9.5 | - |
| No.4 | - | 4.75 | 100.0 |
| No.10 | 0.01 | 2 | 100.0 |
| No.20 | - | 0.85 | 100.0 |
| No.40 | 0.02 | 0.425 | 99.9 |
| No.60 | 0.08 | 0.25 | 99.7 |
| No.100 | 0.22 | 0.15 | 99.1 |
| No.140 | 0.45 | 0.106 | 98.2 |
| No.200 | 1.10 | 0.075 | 95.6 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 21.8 | 18.5 | 0.06877 | 76.74 |
| | 1 | 21.8 | 15.5 | 0.04952 | 64.74 |
| | 2 | 21.8 | 11 | 0.03595 | 46.75 |
| | 5 | 21.8 | 6.5 | 0.02331 | 28.75 |
| | 15 | 21.6 | 4.5 | 0.01364 | 20.48 |
| | 30 | 21.7 | 3 | 0.00971 | 14.62 |
| | 60 | 21.8 | 2 | 0.00689 | 10.75 |
| | 120 | 21.8 | 1 | 0.00490 | 6.75 |
| <=Split | 250 | 22.4 | 0 | 0.00339 | 3.56 |
| | 1436 | 20.7 | 0 | 0.00144 | 1.28 |




**Gravel (%):** 0.0
**Sand (%):** 4.4
**Fines (%):** 95.6

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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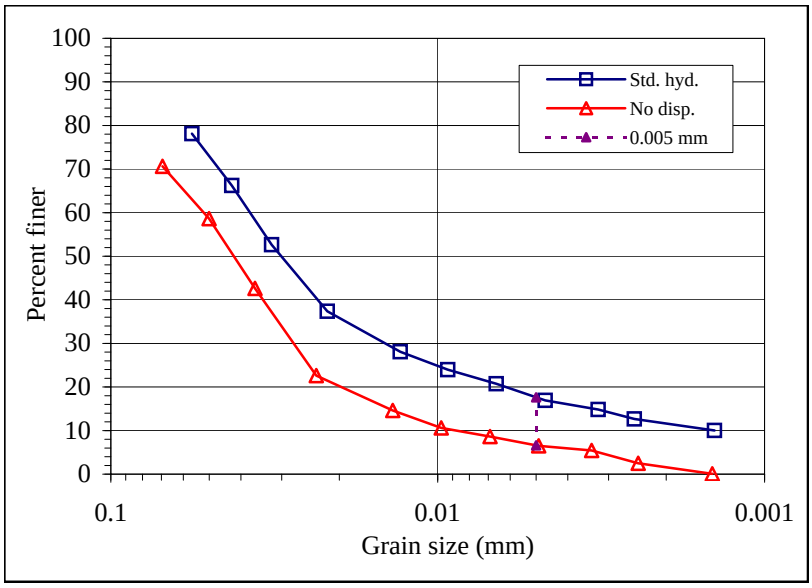
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 6.60 |
| Percent passing 5 um (ASTM D 422) = | 17.63 |
| **Percent Dispersion =** | **37.4** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0565 | 78.1 | | 0.0695 | 70.6 |
| 0.0427 | 66.2 | | 0.0500 | 58.6 |
| 0.0322 | 52.7 | | 0.0362 | 42.6 |
| 0.0218 | 37.4 | | 0.0235 | 22.6 |
| 0.0130 | 28.1 | | 0.0137 | 14.6 |
| 0.0093 | 24.0 | | 0.0098 | 10.6 |
| 0.0066 | 20.7 | | 0.0069 | 8.6 |
| 0.0047 | 16.9 | | 0.0049 | 6.5 |
| 0.0032 | 14.8 | | 0.0034 | 5.4 |
| 0.0025 | 12.7 | | 0.0024 | 2.5 |
| 0.0014 | 10.0 | | 0.0014 | 0.1 |




Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

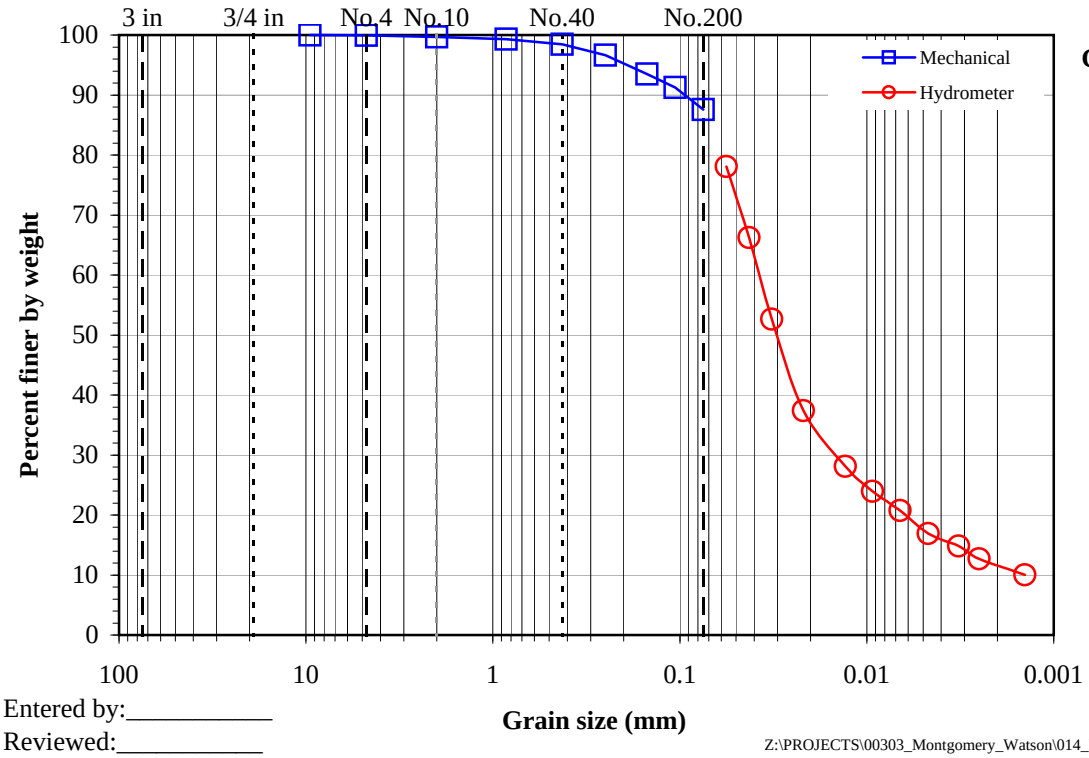
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 471.57 | 463.58 |
| +#10 Coarse fraction (g): | 1.38 | 1.37 |
| -#10 Split fraction (g): | 59.77 | 58.76 |
| Hydrometer fraction (g): | 59.77 | 58.76 |
| Split fraction: | 0.997 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | 41.56 | 96.71 | 96.71 |
| Dry soil + tare (g): | 41.53 | 95.71 | 95.71 |
| Tare (g): | 38.15 | 37.76 | 37.76 |
| Water content (%): | 0.89 | 1.73 | 1.73 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 99.70 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | - |
| 3/8" | - | 9.5 | 100.0 |
| No.4 | 0.25 | 4.75 | 99.9 |
| No.10 | 1.38 | 2 | 99.7 |
| No.20 | 0.23 | 0.85 | 99.3 |
| No.40 | 0.73 | 0.425 | 98.5 |
| No.60 | 1.81 | 0.25 | 96.6 |
| No.100 | 3.65 | 0.15 | 93.5 |
| No.140 | 4.97 | 0.106 | 91.3 |
| No.200 | 7.16 | 0.075 | 87.6 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 17.8 | 50 | 0.05645 | 78.11 |
| | 1 | 17.8 | 43 | 0.04266 | 66.23 |
| | 2 | 17.8 | 35 | 0.03223 | 52.65 |
| | 5 | 17.8 | 26 | 0.02177 | 37.38 |
| | 15 | 17.9 | 20.5 | 0.01301 | 28.09 |
| | 30 | 18.2 | 18 | 0.00931 | 23.95 |
| | 60 | 18.7 | 16 | 0.00662 | 20.75 |
| | 120 | 19.8 | 13.5 | 0.00469 | 16.91 |
| <=Split | 250 | 21 | 12 | 0.00323 | 14.81 |
| | 412 | 22.1 | 10.5 | 0.00250 | 12.68 |
| | 1305 | 21.8 | 9 | 0.00142 | 10.02 |




**Gravel (%):** 0.1
**Sand (%):** 12.4
**Fines (%):** 87.6

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

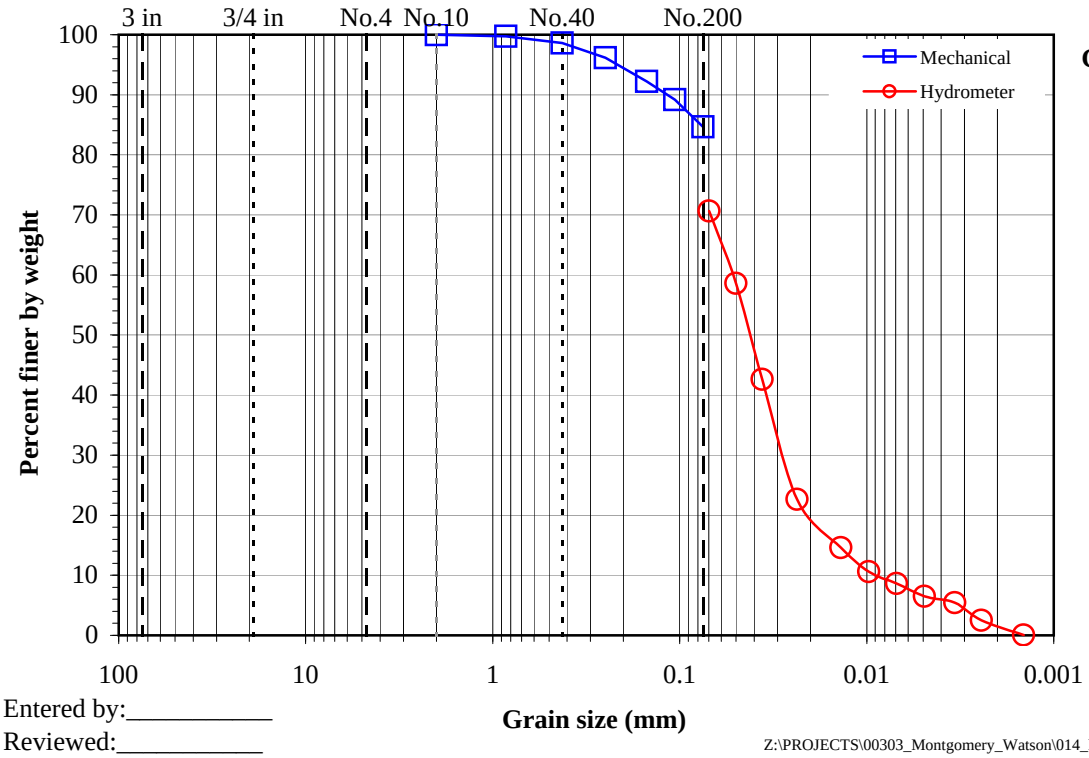
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 25.43 | 25.00 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 25.43 | 25.00 |
| Hydrometer fraction (g): | 25.43 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 96.71 | 96.71 |
| Dry soil + tare (g): | - | 95.71 | 95.71 |
| Tare (g): | - | 37.76 | 37.76 |
| Water content (%): | 0.00 | 1.73 | 1.73 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.07 | 0.85 | 99.7 | |
| No.40 | 0.35 | 0.425 | 98.6 | |
| No.60 | 0.96 | 0.25 | 96.2 | |
| No.100 | 1.94 | 0.15 | 92.2 | |
| No.140 | 2.70 | 0.106 | 89.2 | |
| No.200 | 3.84 | 0.075 | 84.6 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 21.7 | 17 | 0.06952 | 70.62 |
| 1 | 21.7 | 14 | 0.05004 | 58.62 |
| 2 | 21.7 | 10 | 0.03621 | 42.62 |
| 5 | 21.7 | 5 | 0.02353 | 22.62 |
| 15 | 21.7 | 3 | 0.01373 | 14.62 |
| 30 | 21.7 | 2 | 0.00976 | 10.62 |
| 60 | 21.7 | 1.5 | 0.00692 | 8.62 |
| 120 | 21.6 | 1 | 0.00491 | 6.49 |
| 250 | 22.3 | 0.5 | 0.00338 | 5.42 |
| 477 | 23.1 | -0.5 | 0.00244 | 2.50 |
| 1432 | 20.7 | -0.3 | 0.00145 | 0.08 |




**Gravel (%):** 0.0
**Sand (%):** 15.4
**Fines (%):** 84.6

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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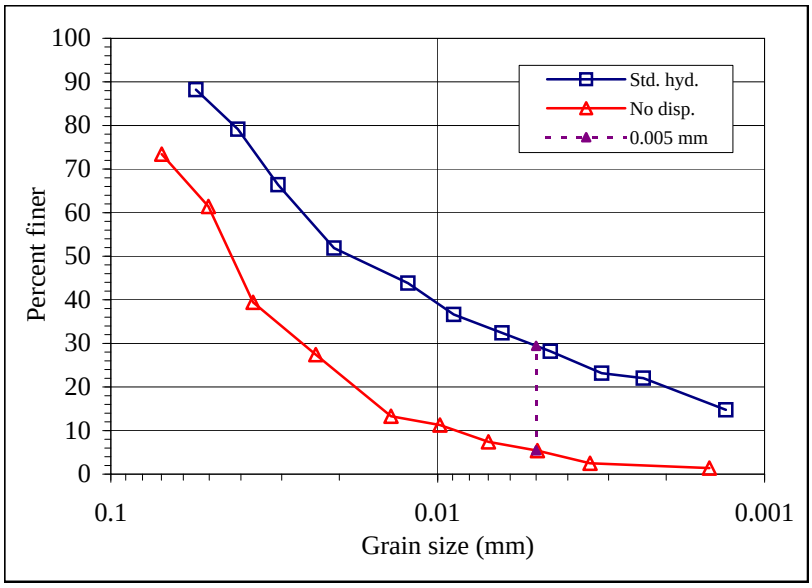
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 5.46 |
| Percent passing 5 um (ASTM D 422) = | 29.43 |
| **Percent Dispersion =** | **18.6** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0549 | 88.2 | | 0.0698 | 73.4 |
| 0.0409 | 79.1 | | 0.0503 | 61.4 |
| 0.0308 | 66.4 | | 0.0367 | 39.4 |
| 0.0207 | 51.9 | | 0.0236 | 27.4 |
| 0.0123 | 43.8 | | 0.0139 | 13.3 |
| 0.0089 | 36.6 | | 0.0098 | 11.3 |
| 0.0064 | 32.4 | | 0.0070 | 7.4 |
| 0.0045 | 28.2 | | 0.0050 | 5.4 |
| 0.0032 | 23.2 | | 0.0034 | 2.5 |
| 0.0024 | 22.0 | | 0.0015 | 1.4 |
| 0.0013 | 14.8 | | | |




Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

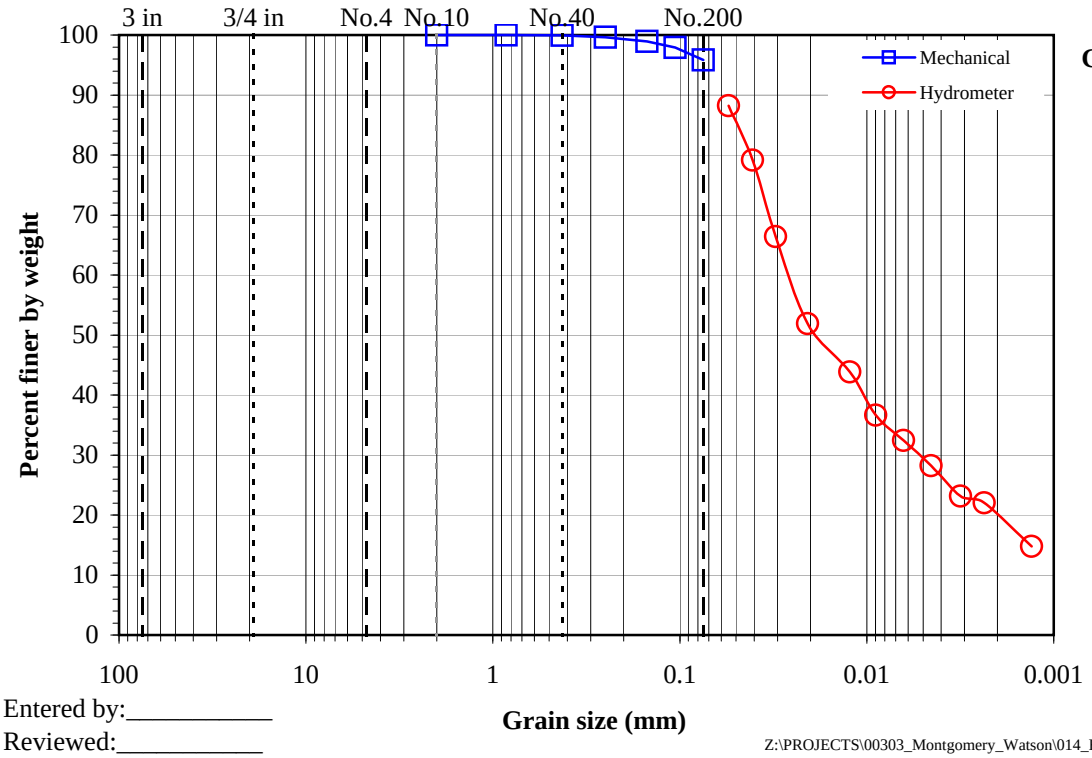
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 56.17 | 55.03 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 56.17 | 55.03 |
| Hydrometer fraction (g): | 56.17 | 55.03 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 111.09 | 111.09 |
| Dry soil + tare (g): | - | 109.59 | 109.59 |
| Tare (g): | - | 37.30 | 37.30 |
| Water content (%): | 0.00 | 2.07 | 2.07 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.01 | 0.85 | 100.0 | |
| No.40 | 0.02 | 0.425 | 100.0 | |
| No.60 | 0.22 | 0.25 | 99.6 | |
| No.100 | 0.60 | 0.15 | 98.9 | |
| No.140 | 1.14 | 0.106 | 97.9 | |
| No.200 | 2.28 | 0.075 | 95.9 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 17.9 | 52.5 | 0.05493 | 88.23 |
| 1 | 17.9 | 47.5 | 0.04086 | 79.14 |
| 2 | 17.9 | 40.5 | 0.03078 | 66.42 |
| 5 | 17.9 | 32.5 | 0.02075 | 51.88 |
| 15 | 18.2 | 28 | 0.01233 | 43.83 |
| 30 | 18.4 | 24 | 0.00894 | 36.64 |
| 60 | 19.2 | 21.5 | 0.00636 | 32.41 |
| 120 | 20 | 19 | 0.00452 | 28.19 |
| 250 | 21.1 | 16 | 0.00315 | 23.17 |
| 436 | 22.8 | 15 | 0.00235 | 22.03 |
| 1461 | 22.8 | 11 | 0.00131 | 14.76 |




**Gravel (%):** 0.0
**Sand (%):** 4.1
**Fines (%):** 95.9

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D4221)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

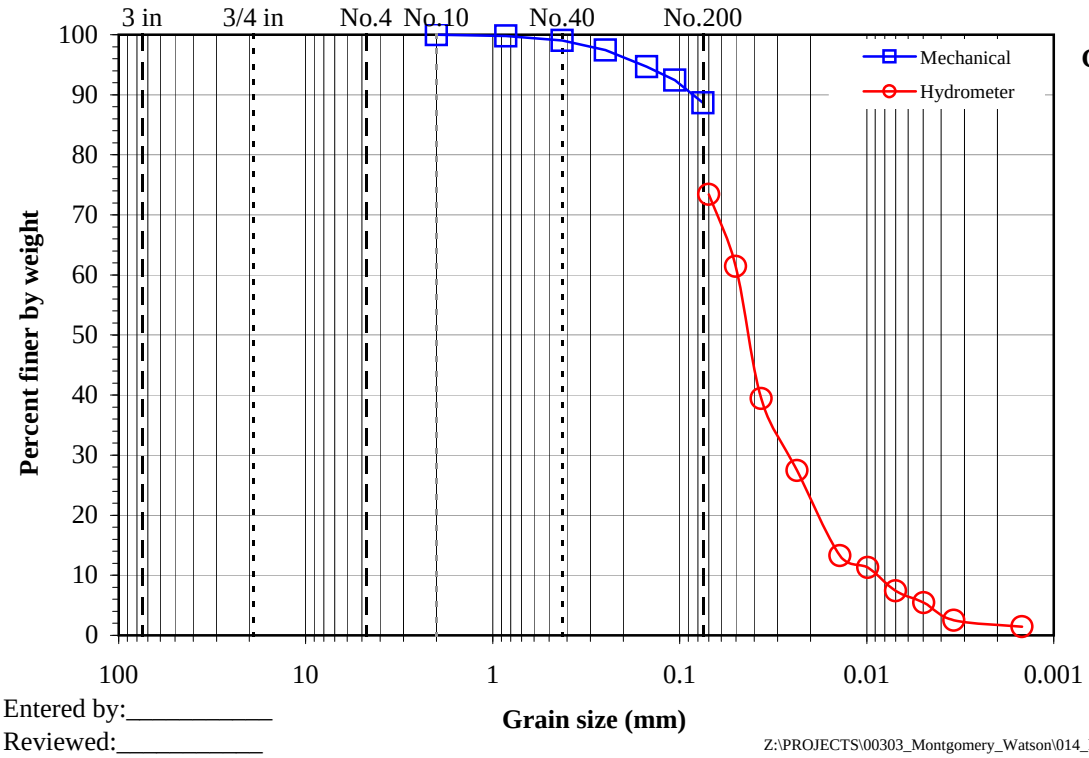
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | #10 | |
| | Moist | Dry |
| Total sample wt. (g): | 25.52 | 25.00 |
| +#10 Coarse fraction (g): | | 0.00 |
| -#10 Split fraction (g): | 25.52 | 25.00 |
| Hydrometer fraction (g): | 25.52 | 25.00 |
| Split fraction: | 1.000 | |

| Water content data | C.F.(+#10) | S.F.(-#10) | Hyd.(-No.10) |
|---|---|---|---|
| Moist soil + tare (g): | - | 111.09 | 111.09 |
| Dry soil + tare (g): | - | 109.59 | 109.59 |
| Tare (g): | - | 37.30 | 37.30 |
| Water content (%): | 0.00 | 2.07 | 2.07 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 100.00 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer | |
|---|---|---|---|---|
| 8" | - | 200 | - | |
| 6" | - | 150 | - | |
| 4" | - | 100 | - | |
| 3" | - | 75 | - | |
| 1.5" | - | 37.5 | - | |
| 3/4" | - | 19 | - | |
| 3/8" | - | 9.5 | - | |
| No.4 | - | 4.75 | - | |
| No.10 | - | 2 | 100.0 | <=Split |
| No.20 | 0.05 | 0.85 | 99.8 | |
| No.40 | 0.24 | 0.425 | 99.0 | |
| No.60 | 0.64 | 0.25 | 97.4 | |
| No.100 | 1.33 | 0.15 | 94.7 | |
| No.140 | 1.89 | 0.106 | 92.4 | |
| No.200 | 2.84 | 0.075 | 88.6 | |

| Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|
| 0.5 | 20.8 | 18 | 0.06984 | 73.41 |
| 1 | 20.8 | 15 | 0.05029 | 61.41 |
| 2 | 20.8 | 9.5 | 0.03670 | 39.41 |
| 5 | 20.8 | 6.5 | 0.02360 | 27.41 |
| 15 | 20.7 | 3 | 0.01389 | 13.28 |
| 30 | 20.7 | 2.5 | 0.00985 | 11.28 |
| 60 | 20.8 | 1.5 | 0.00699 | 7.41 |
| 120 | 20.8 | 1 | 0.00496 | 5.41 |
| 250 | 21.6 | 0 | 0.00342 | 2.48 |
| 1370 | 20.8 | 0 | 0.00147 | 1.41 |




**Gravel (%):** 0.0
**Sand (%):** 11.4
**Fines (%):** 88.6

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

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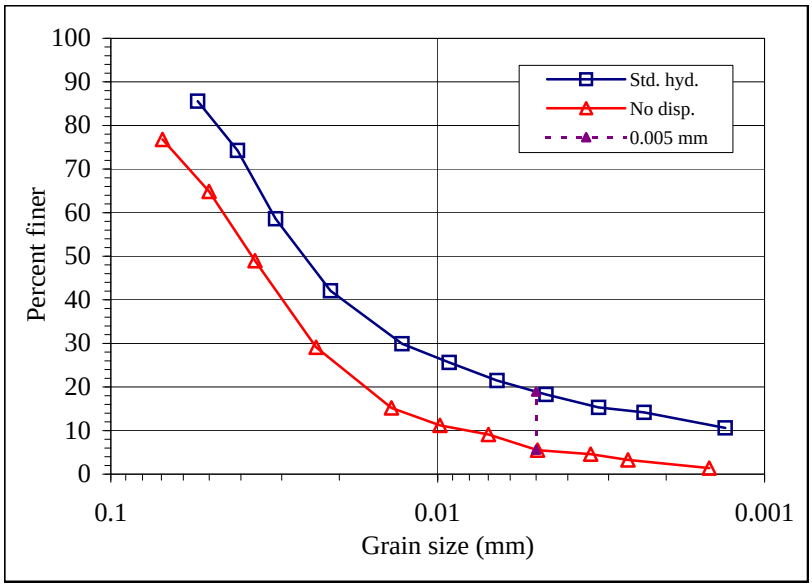
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP009-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 5.62 |
| Percent passing 5 um (ASTM D 422) = | 18.93 |
| **Percent Dispersion =** | **29.7** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0542 | 85.6 | | 0.0695 | 76.8 |
| 0.0409 | 74.3 | | 0.0500 | 64.9 |
| 0.0313 | 58.6 | | 0.0362 | 49.0 |
| 0.0213 | 42.1 | | 0.0236 | 29.1 |
| 0.0129 | 29.9 | | 0.0139 | 15.2 |
| 0.0092 | 25.6 | | 0.0098 | 11.2 |
| 0.0066 | 21.5 | | 0.0070 | 9.1 |
| 0.0047 | 18.3 | | 0.0049 | 5.5 |
| 0.0032 | 15.3 | | 0.0034 | 4.6 |
| 0.0023 | 14.2 | | 0.0026 | 3.3 |
| 0.0013 | 10.6 | | 0.0015 | 1.4 |




Entered by:_____
Reviewed:_____

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# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP009-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

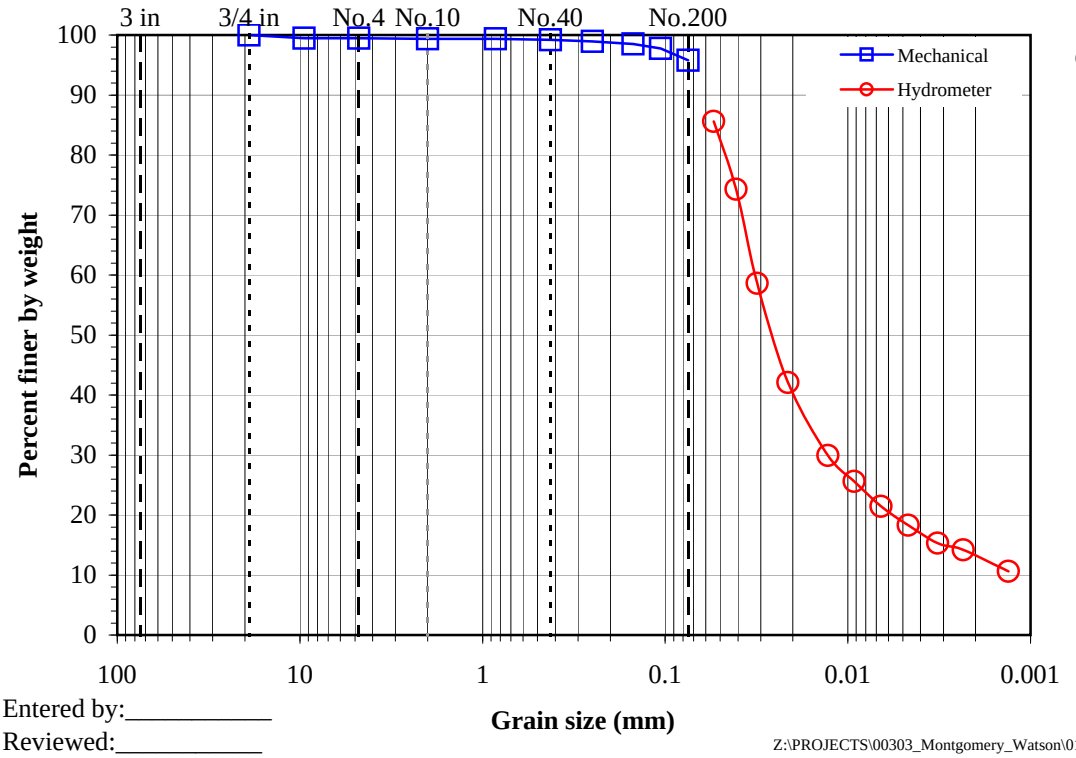
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | 3/8" | |
| | Moist | Dry |
| Total sample wt. (g): | 22005.77 | 20355.03 |
| +3/8" Coarse fraction (g): | 112.96 | 112.53 |
| -3/8" Split fraction (g): | 518.78 | 511.47 |
| Hydrometer fraction (g): | 58.07 | 57.11 |
| Split fraction: | 0.994 | |

| Water content data | C.F.(+3/8") | S.F.(-3/8") | Hyd.(+No.10) | Hyd.(-No.10) |
|---|---|---|---|---|
| Moist soil + tare (g): | 241.03 | 660.11 | 38.52 | 55.26 |
| Dry soil + tare (g): | 240.59 | 619.64 | 38.51 | 54.97 |
| Tare (g): | 126.36 | 123.24 | 37.81 | 37.72 |
| Water content (%): | 0.39 | 8.15 | 1.43 | 1.68 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Dispersion period (min): | 15 | | Hyd. fraction: | 99.37 |
| | | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | 100.0 |
| 3/8" | 112.53 | 9.5 | 99.4 |
| No.4 | - | 4.75 | 99.4 |
| No.10 | 0.39 | 2 | 99.4 |
| No.20 | 0.01 | 0.85 | 99.4 |
| No.40 | 0.11 | 0.425 | 99.2 |
| No.60 | 0.25 | 0.25 | 98.9 |
| No.100 | 0.50 | 0.15 | 98.5 |
| No.140 | 0.92 | 0.106 | 97.8 |
| No.200 | 2.07 | 0.075 | 95.8 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 18.5 | 53 | 0.05422 | 85.58 |
| | 1 | 18.5 | 46.5 | 0.04094 | 74.27 |
| | 2 | 18.5 | 37.5 | 0.03132 | 58.61 |
| | 5 | 18.5 | 28 | 0.02127 | 42.08 |
| | 15 | 18.6 | 21 | 0.01286 | 29.94 |
| | 30 | 18.7 | 18.5 | 0.00922 | 25.62 |
| <=Split | 60 | 19.2 | 16 | 0.00658 | 21.46 |
| | 120 | 20 | 14 | 0.00466 | 18.29 |
| <=Split hyd. | 250 | 21.3 | 12 | 0.00322 | 15.30 |
| | 461 | 22.9 | 11 | 0.00234 | 14.17 |
| | 1486 | 22.7 | 9 | 0.00132 | 10.62 |




**Gravel (%):** 0.6
**Sand (%):** 3.7
**Fines (%):** 95.8

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP009-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay

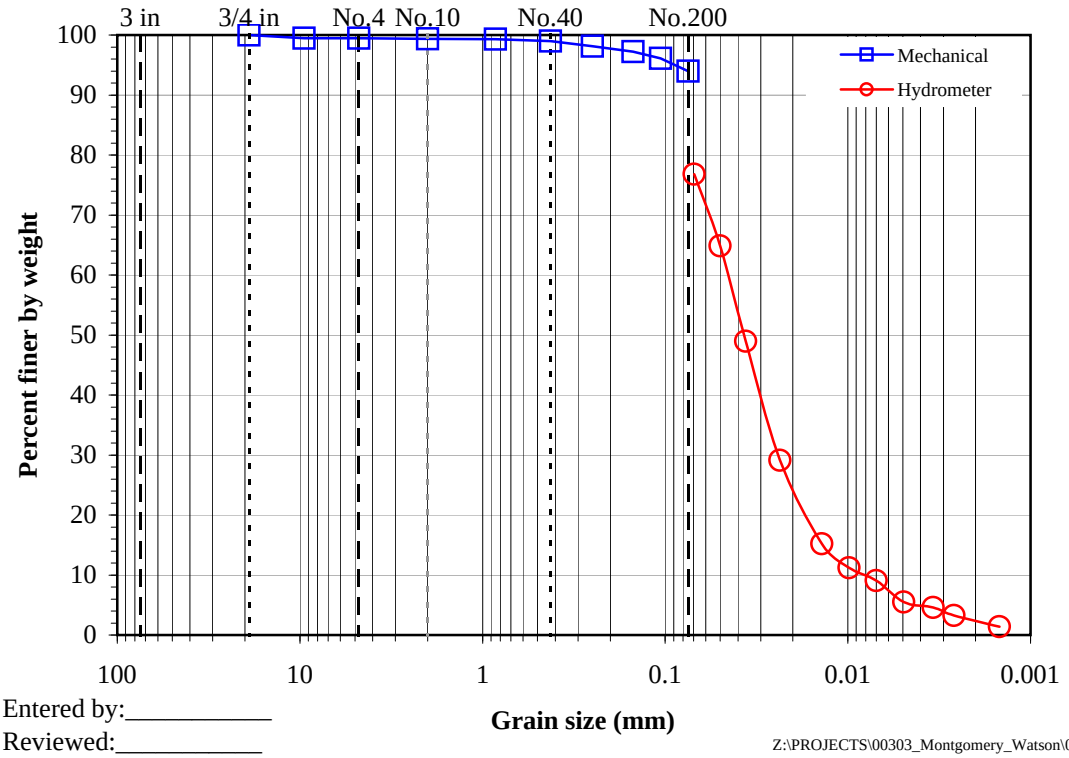
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | 3/8" | |
| | Moist | Dry |
| Total sample wt. (g): | 22005.77 | 20355.03 |
| +3/8" Coarse fraction (g): | 112.96 | 112.53 |
| -3/8" Split fraction (g): | 518.78 | 511.47 |
| Hydrometer fraction (g): | 25.42 | 25.00 |
| Split fraction: | 0.994 | |

| Water content data | C.F.(+3/8") | S.F.(-3/8") | Hyd.(+No.10) | Hyd.(-No.10) |
|---|---|---|---|---|
| Moist soil + tare (g): | 241.03 | 660.11 | 38.52 | 55.26 |
| Dry soil + tare (g): | 240.59 | 619.64 | 38.51 | 54.97 |
| Tare (g): | 126.36 | 123.24 | 37.81 | 37.72 |
| Water content (%): | 0.39 | 8.15 | 1.43 | 1.68 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 99.37 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | 100.0 |
| 3/8" | 112.53 | 9.5 | 99.4 |
| No.4 | - | 4.75 | 99.4 |
| No.10 | 0.39 | 2 | 99.4 |
| No.20 | 0.02 | 0.85 | 99.3 |
| No.40 | 0.10 | 0.425 | 99.0 |
| No.60 | 0.31 | 0.25 | 98.1 |
| No.100 | 0.54 | 0.15 | 97.2 |
| No.140 | 0.82 | 0.106 | 96.1 |
| No.200 | 1.36 | 0.075 | 94.0 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 20.7 | 19 | 0.06948 | 76.79 |
| | 1 | 20.7 | 16 | 0.05004 | 64.87 |
| | 2 | 20.7 | 12 | 0.03622 | 48.97 |
| | 5 | 20.7 | 7 | 0.02356 | 29.09 |
| | 15 | 20.7 | 3.5 | 0.01386 | 15.18 |
| | 30 | 20.7 | 2.5 | 0.00985 | 11.21 |
| <=Split | 60 | 20.6 | 2 | 0.00699 | 9.09 |
| | 120 | 20.9 | 1 | 0.00495 | 5.51 |
| <=Split hyd. | 250 | 21.7 | 0.5 | 0.00341 | 4.59 |
| | 420 | 22.2 | 0 | 0.00262 | 3.27 |
| | 1367 | 20.8 | 0 | 0.00148 | 1.40 |




**Gravel (%):** 0.6
**Sand (%):** 5.5
**Fines (%):** 94.0

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Dispersive Characteristics of Clay Soil by Double Hydrometer

**(ASTM D 4221)**

IGES

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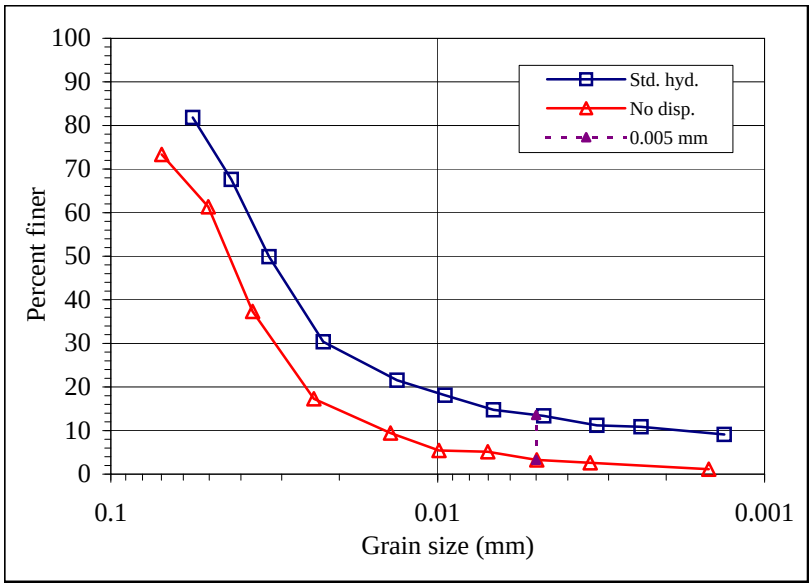
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP010-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

| | |
|---|---|
| Percent passing 5 um (ASTM D 4221) = | 3.31 |
| Percent passing 5 um (ASTM D 422) = | 13.58 |
| **Percent Dispersion =** | **24.4** |

| Standard Hyd. (ASTM D 422) | | | Double Hyd. (ASTM D 4221) | |
|---|---|---|---|---|
| I | J | | I | J |
| Particle size (mm) | Percent finer | | Particle size (mm) | Percent finer |
| 0.0562 | 81.8 | | 0.0699 | 73.4 |
| 0.0428 | 67.6 | | 0.0503 | 61.3 |
| 0.0328 | 49.9 | | 0.0368 | 37.3 |
| 0.0224 | 30.4 | | 0.0239 | 17.3 |
| 0.0133 | 21.5 | | 0.0139 | 9.4 |
| 0.0095 | 18.1 | | 0.0099 | 5.4 |
| 0.0067 | 14.8 | | 0.0070 | 5.2 |
| 0.0047 | 13.4 | | 0.0050 | 3.3 |
| 0.0033 | 11.2 | | 0.0034 | 2.6 |
| 0.0024 | 10.9 | | 0.0015 | 1.1 |
| 0.0013 | 9.1 | | | |




Entered by:_____
Reviewed:_____

Z:\PROJECTS\00303_Montgomery_Watson\014_FMC_Pocatello\[GSD+hyd_double.xls]Summary

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

IGES

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP010-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

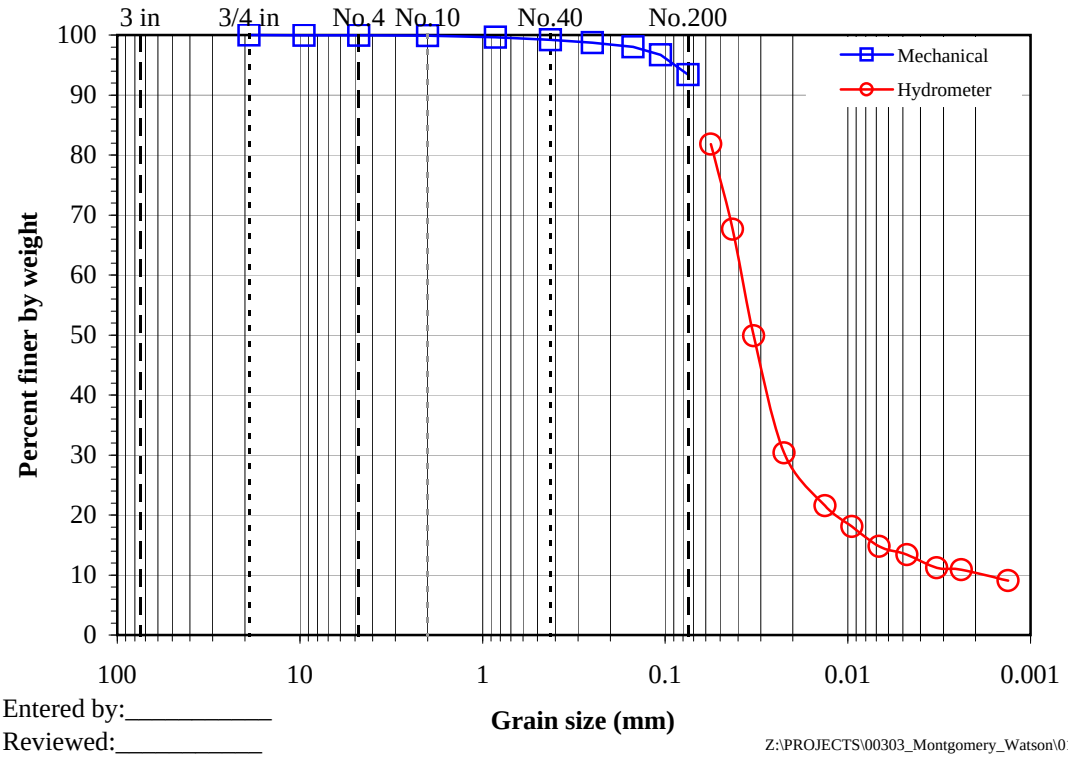
| | | |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | 3/8" | |
| | Moist | Dry |
| Total sample wt. (g): | 21537.22 | 20320.52 |
| +3/8" Coarse fraction (g): | 16.12 | 15.99 |
| -3/8" Split fraction (g): | 373.84 | 373.84 |
| Hydrometer fraction (g): | 57.15 | 56.32 |
| Split fraction: | 0.999 | |

| Water content data | C.F.(+3/8") | S.F.(-3/8") | Hyd.(+No.10) | Hyd.(-No.10) |
|---|---|---|---|---|
| Moist soil + tare (g): | 140.19 | 485.30 | 36.95 | 60.98 |
| Dry soil + tare (g): | 140.06 | 464.88 | 36.95 | 60.64 |
| Tare (g): | 124.07 | 124.07 | 36.93 | 37.60 |
| Water content (%): | 0.81 | 5.99 | 0.00 | 1.48 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Slope: | -0.1641 | | | |
| Hyd. split: | No.10 | | Intercept: | 16.3 |
| Gs: | 2.65 | Assumed | α: | 1.00 |
| Bulb No. | 2 | | Hyd. fraction: | 99.92 |
| Dispersion period (min): | 15 | | Dispersion device: | Air-jet |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | 100.0 |
| 3/8" | 15.99 | 9.5 | 99.9 |
| No.4 | - | 4.75 | 99.9 |
| No.10 | 0.01 | 2 | 99.9 |
| No.20 | 0.15 | 0.85 | 99.7 |
| No.40 | 0.40 | 0.425 | 99.2 |
| No.60 | 0.67 | 0.25 | 98.7 |
| No.100 | 1.06 | 0.15 | 98.0 |
| No.140 | 1.82 | 0.106 | 96.7 |
| No.200 | 3.67 | 0.075 | 93.4 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 18.2 | 50 | 0.05616 | 81.82 |
| | 1 | 18.2 | 42 | 0.04281 | 67.63 |
| | 2 | 18.2 | 32 | 0.03281 | 49.88 |
| | 5 | 18.2 | 21 | 0.02238 | 30.37 |
| | 15 | 18.3 | 16 | 0.01331 | 21.54 |
| | 30 | 18.6 | 14 | 0.00949 | 18.10 |
| <=Split | 60 | 19.1 | 12 | 0.00675 | 14.75 |
| | 120 | 20.1 | 11 | 0.00474 | 13.36 |
| <=Split hyd. | 250 | 21.4 | 9.5 | 0.00326 | 11.21 |
| | 453 | 22.8 | 9 | 0.00239 | 10.86 |
| | 1477 | 22.8 | 8 | 0.00133 | 9.09 |




**Gravel (%):** 0.1
**Sand (%):** 6.5
**Fines (%):** 93.4

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Particle-Size Analysis of Soils *with hydrometer*

**(ASTM D422)**

© IGES 2004, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

**Boring No.:** WUA-TP010-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt

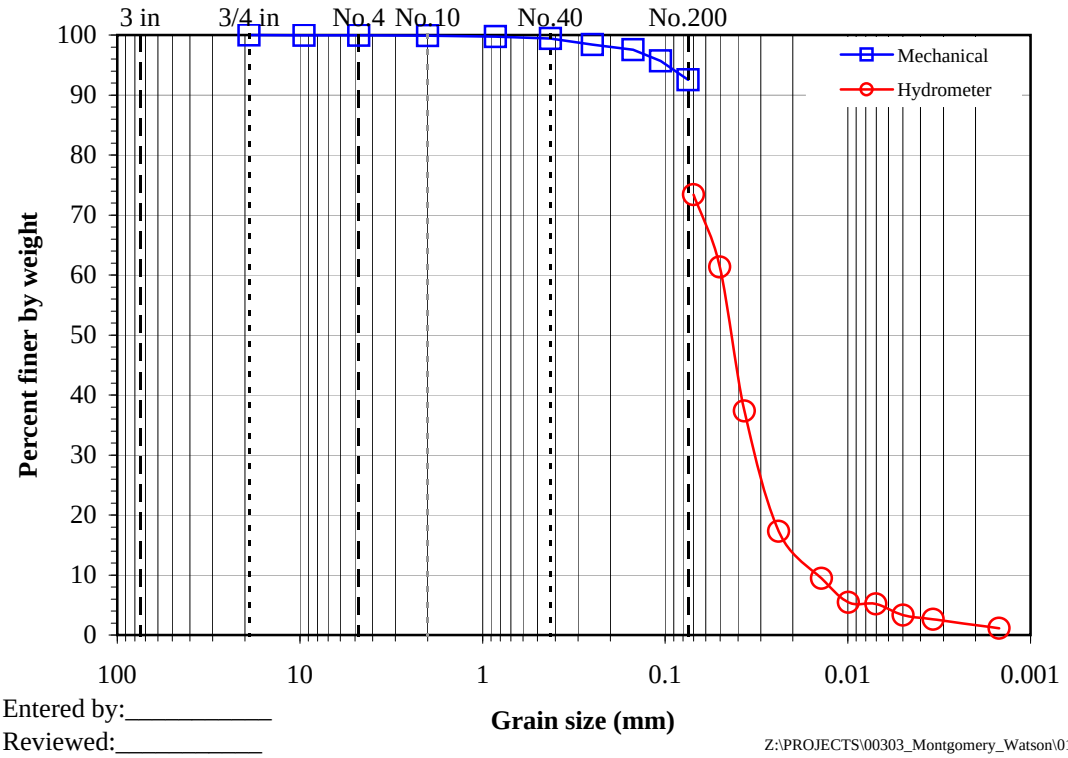
| | Moist | Dry |
|---|---|---|
| Split sieve: | Yes | |
| Split sieve: | 3/8" | |
| Total sample wt. (g): | 21537.22 | 20320.52 |
| +3/8" Coarse fraction (g): | 16.12 | 15.99 |
| -3/8" Split fraction (g): | 373.84 | 373.84 |
| Hydrometer fraction (g): | 25.32 | 24.95 |
| Split fraction: | 0.999 | |

| Water content data | C.F.(+3/8") | S.F.(-3/8") | Hyd.(+No.10) | Hyd.(-No.10) |
|---|---|---|---|---|
| Moist soil + tare (g): | 140.19 | 485.30 | 36.95 | 60.98 |
| Dry soil + tare (g): | 140.06 | 464.88 | 36.95 | 60.64 |
| Tare (g): | 124.07 | 124.07 | 36.93 | 37.60 |
| Water content (%): | 0.81 | 5.99 | 0.00 | 1.48 |

| Hydrometer data | | | | |
|---|---|---|---|---|
| Hyd. split: | No.10 | | Slope: | -0.1641 |
| Gs: | 2.65 | Assumed | Intercept: | 16.3 |
| Bulb No. | 2 | | α: | 1.00 |
| Vacuum period (min): | 10 | | Hyd. fraction: | 99.92 |
| | | | Dispersion device: | None |

| Sieve | Accum. Wt. Ret. (g) | Grain Size (mm) | Percent Finer |
|---|---|---|---|
| 8" | - | 200 | - |
| 6" | - | 150 | - |
| 4" | - | 100 | - |
| 3" | - | 75 | - |
| 1.5" | - | 37.5 | - |
| 3/4" | - | 19 | 100.0 |
| 3/8" | 15.99 | 9.5 | 99.9 |
| No.4 | - | 4.75 | 99.9 |
| No.10 | 0.01 | 2 | 99.9 |
| No.20 | 0.05 | 0.85 | 99.7 |
| No.40 | 0.13 | 0.425 | 99.4 |
| No.60 | 0.38 | 0.25 | 98.4 |
| No.100 | 0.59 | 0.15 | 97.6 |
| No.140 | 1.06 | 0.106 | 95.7 |
| No.200 | 1.85 | 0.075 | 92.5 |

| | Elapsed time (min) | Temp. (°C) | Hydrometer Reading | Grain Size (mm) | % Soil in Suspension |
|---|---|---|---|---|---|
| | 0.5 | 20.7 | 18 | 0.06991 | 73.36 |
| | 1 | 20.7 | 15 | 0.05034 | 61.35 |
| | 2 | 20.7 | 9 | 0.03684 | 37.32 |
| | 5 | 20.7 | 4 | 0.02394 | 17.30 |
| | 15 | 20.8 | 2 | 0.01395 | 9.42 |
| | 30 | 20.8 | 1 | 0.00991 | 5.42 |
| <=Split | 60 | 20.6 | 1 | 0.00703 | 5.15 |
| | 120 | 20.7 | 0.5 | 0.00497 | 3.28 |
| <=Split hyd. | 250 | 21.7 | 0 | 0.00341 | 2.62 |
| | 1363 | 20.6 | 0 | 0.00148 | 1.15 |




**Gravel (%):** 0.1
**Sand (%):** 7.4
**Fines (%):** 92.5

Comments:
Vacuum applied and no flocculating agent used.

Entered by:_____
Reviewed:_____

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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 61.86 | |
| Dry soil + tare (g) | 58.92 | |
| Tare (g) | 37.78 | |
| Water content, w (%) | 13.9 | |

Initial water temperature: 20.1 °C
Date test started: 11/20/2013
Time at beginning of test: 9:31

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 2 | 20.2 | 2 | 19.6 | 2 | 19.4 |
| 2 | 2 | 20 | 2 | 19.3 | 2 | 19.5 |
| 3 | 1 | 19.5 | 1 | 18.8 | 2 | 20 |
| 4 | 1 | 19.7 | 1 | 19 | 2 | 20.2 |

**Dispersive classification: Grade 2-Intermediate**

Entered: _____
Reviewed: _____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP002-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 51.71 | |
| Dry soil + tare (g) | 49.86 | |
| Tare (g) | 36.95 | |
| Water content, w (%) | 14.3 | |

Initial water temperature: 20 °C
Date test started: 11/20/2013
Time at beginning of test: 9:32

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 2 | 20 | 2 | 19.2 | 2 | 19.6 |
| 2 | 2 | 20 | 2 | 19.2 | 2 | 19.6 |
| 3 | 1 | 19.5 | 1 | 18.9 | 2 | 19.9 |
| 4 | 2 | 19.7 | 2 | 19 | 2 | 20 |

**Dispersive classification: Grade 2-Intermediate**

Entered: _____
Reviewed: _____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP003-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 76.19 | |
| Dry soil + tare (g) | 74.20 | |
| Tare (g) | 37.76 | |
| Water content, w (%) | 5.5 | |

Initial water temperature: 19.9 °C
Date test started: 11/20/2013
Time at beginning of test: 9:32

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 3 | 19.9 | 3 | 19.1 | 2 | 19.5 |
| 2 | 3 | 20 | 3 | 19.1 | 2 | 19.7 |
| 3 | 1 | 20.1 | 1 | 19.3 | 1 | 18.5 |
| 4 | 1 | 20 | 1 | 19.2 | 1 | 18.5 |

**Dispersive classification: Grade 3-Dispersive**

Entered: _____
Reviewed: _____

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# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 59.79 | |
| Dry soil + tare (g) | 58.67 | |
| Tare (g) | 37.72 | |
| Water content, w (%) | 5.3 | |

Initial water temperature: 19.6 °C
Date test started: 11/21/2013
Time at beginning of test: 9:06

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 1 | 19.7 | 2 | 18.1 | 1 | 18.3 |
| 2 | 2 | 19.6 | 1 | 18 | 1 | 18.3 |

**Dispersive classification: Grade 1-Nondispersive**

Entered: _____
Reviewed: _____

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# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP005-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 63.86 | |
| Dry soil + tare (g) | 62.44 | |
| Tare (g) | 37.70 | |
| Water content, w (%) | 5.7 | |

Initial water temperature: 19.5 °C
Date test started: 11/21/2013
Time at beginning of test: 9:06

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 1 | 19.5 | 1 | 17.8 | 1 | 18.3 |
| 2 | 2 | 19.5 | 1 | 17.9 | 1 | 18.3 |

**Dispersive classification: Grade 1-Nondispersive**

Entered: _____
Reviewed: _____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 61.25 | |
| Dry soil + tare (g) | 59.25 | |
| Tare (g) | 37.25 | |
| Water content, w (%) | 9.1 | |

Initial water temperature: 19.6 °C
Date test started: 11/21/2013
Time at beginning of test: 9:06

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 2 | 19.5 | 2 | 18 | 2 | 18.3 |
| 2 | 3 | 19.6 | 3 | 18 | 3 | 18.3 |

**Dispersive classification: Grade 3-Dispersive**

Entered: _____
Reviewed: _____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 68.30 | |
| Dry soil + tare (g) | 65.27 | |
| Tare (g) | 37.59 | |
| Water content, w (%) | 10.9 | |

Initial water temperature: 19 °C
Date test started: 11/22/2013
Time at beginning of test: 8:58

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 1 | 18.9 | 1 | 18.4 | 1 | 18.2 |
| 2 | 2 | 19 | 2 | 18.3 | 2 | 18.4 |

**Dispersive classification: Grade 2-Intermediate**

Entered: _____
Reviewed: _____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 63.64 | |
| Dry soil + tare (g) | 62.32 | |
| Tare (g) | 37.82 | |
| Water content, w (%) | 5.4 | |

Initial water temperature: 19.1 °C
Date test started: 11/22/2013
Time at beginning of test: 8:58

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 3 | 19.1 | 3 | 18.3 | 3 | 18.2 |
| 2 | 1 | 19 | 1 | 18.4 | 1 | 18.2 |

**Dispersive classification: Grade 2-Intermediate**

Entered: _____
Reviewed: _____

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# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP009-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 55.50 | |
| Dry soil + tare (g) | 54.17 | |
| Tare (g) | 38.14 | |
| Water content, w (%) | 8.3 | |

Initial water temperature: 19 °C
Date test started: 11/22/2013
Time at beginning of test: 8:58

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 1 | 19 | 1 | 18.4 | 1 | 18.2 |
| 2 | 1 | 19 | 1 | 18.4 | 1 | 18.2 |

**Dispersive classification: Grade 1-Nondispersive**

Entered: _____
Reviewed: _____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

*(ASTM D6572)*

© IGES 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

**Boring No.:** WUA-TP010-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

| | | |
|---|---|---|
| Specific Gravity, Gs: | 2.65 | Assumed |
| Curing Time: | 0 | minutes |
| Water used: | Distilled | |
| Water content: | Natural | |
| Wet soil + tare (g) | 55.73 | |
| Dry soil + tare (g) | 54.92 | |
| Tare (g) | 37.60 | |
| Water content, w (%) | 4.7 | |

Initial water temperature: 19.8 °C
Date test started: 11/26/2013
Time at beginning of test: 8:58

| Specimen Number | 2 minutes | | 1 hour | | 6 hours | |
|---|---|---|---|---|---|---|
| | Grade | Temp. (°C) | Grade | Temp. (°C) | Grade | Temp. (°C) |
| 1 | 1 | 20 | 1 | 19.1 | 1 | 20.7 |
| 2 | 1 | 19.7 | 1 | 19 | 1 | 20 |

**Dispersive classification: Grade 1-Nondispersive**

Entered: _____
Reviewed: _____

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/21/2013
By: MP

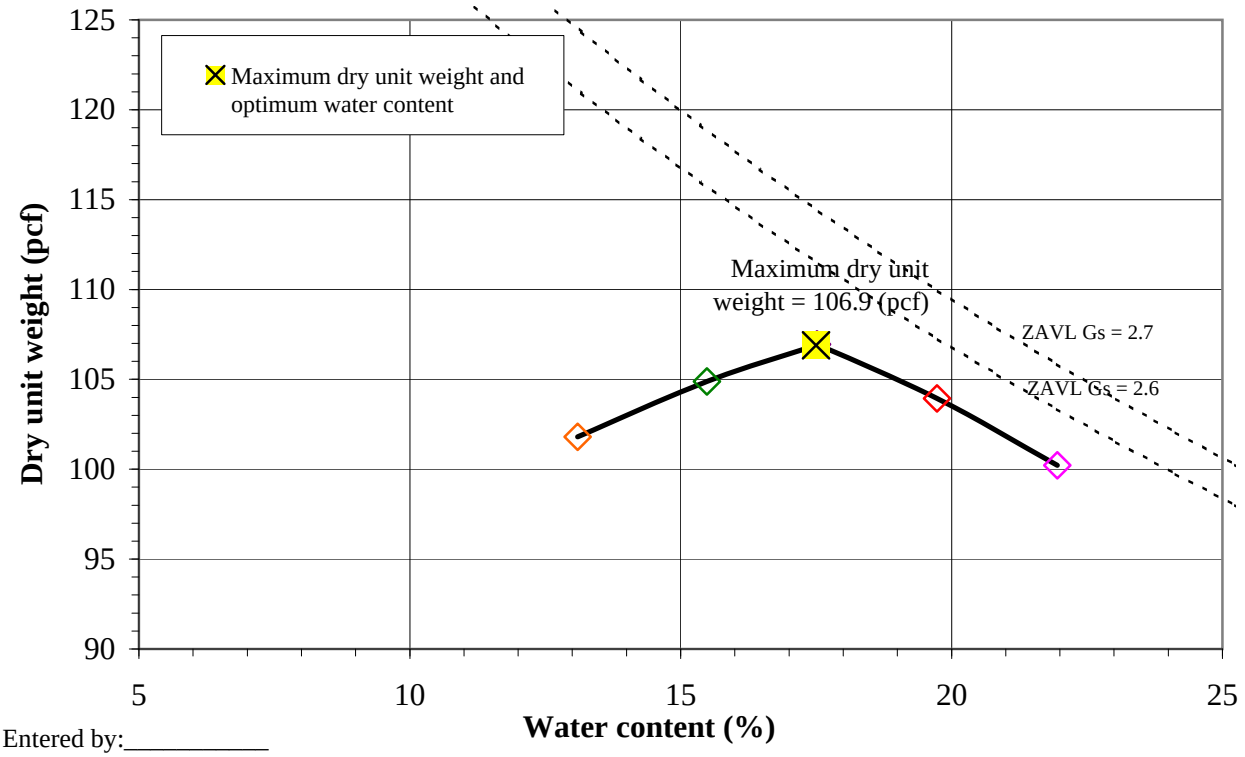
**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 2
Mold volume ($ft^3$): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 17.5
**Maximum dry unit weight (pcf):** 106.9

| Point Number | +4% | +6% | +2% | +8% | As Is | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 6055.2 | 6036.4 | 5986.4 | 6003.0 | 5896.2 | | | |
| Wt. of Mold (g) | 4160.1 | 4160.1 | 4160.1 | 4160.1 | 4160.1 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 125.7 | 124.4 | 121.1 | 122.2 | 115.1 | | | |
| Wet Soil + Tare (g) | 565.86 | 646.42 | 627.72 | 578.78 | 537.19 | | | |
| Dry Soil + Tare (g) | 499.95 | 563.05 | 560.18 | 497.56 | 489.13 | | | |
| Tare (g) | 123.73 | 140.46 | 123.93 | 127.54 | 122.22 | | | |
| Water Content, w (%) | **17.5** | **19.7** | **15.5** | **22.0** | **13.1** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **106.9** | **103.9** | **104.9** | **100.2** | **101.8** | | | |

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Reviewed:_____

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/21/2013
By: DKS

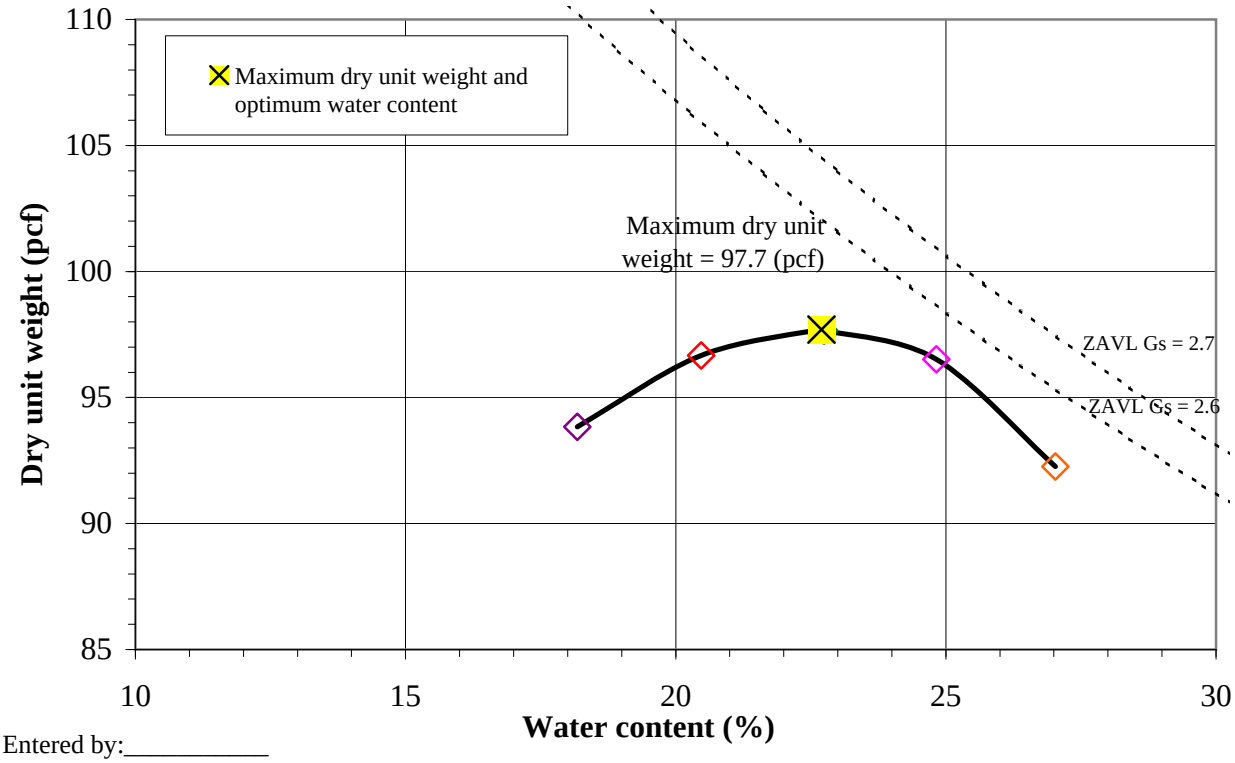
**Boring No.:** WUA-TP002-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown clay
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 2
Mold volume ($ft^3$): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 22.7
**Maximum dry unit weight (pcf):** 97.7

| Point Number | +4% | +6% | +8% | +10% | +12% | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 5832.2 | 5916.0 | 5967.7 | 5976.6 | 5927.2 | | | |
| Wt. of Mold (g) | 4160.1 | 4160.1 | 4160.1 | 4160.1 | 4160.1 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 110.9 | 116.5 | 119.9 | 120.5 | 117.2 | | | |
| Wet Soil + Tare (g) | 629.80 | 842.24 | 824.58 | 833.17 | 945.37 | | | |
| Dry Soil + Tare (g) | 551.61 | 723.01 | 694.50 | 691.81 | 790.71 | | | |
| Tare (g) | 121.43 | 140.49 | 122.65 | 122.35 | 218.49 | | | |
| Water Content, w (%) | **18.2** | **20.5** | **22.7** | **24.8** | **27.0** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **93.8** | **96.7** | **97.7** | **96.5** | **92.3** | | | |




Entered by:_____

Reviewed:_____

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/21/2013
By: MP/DKS

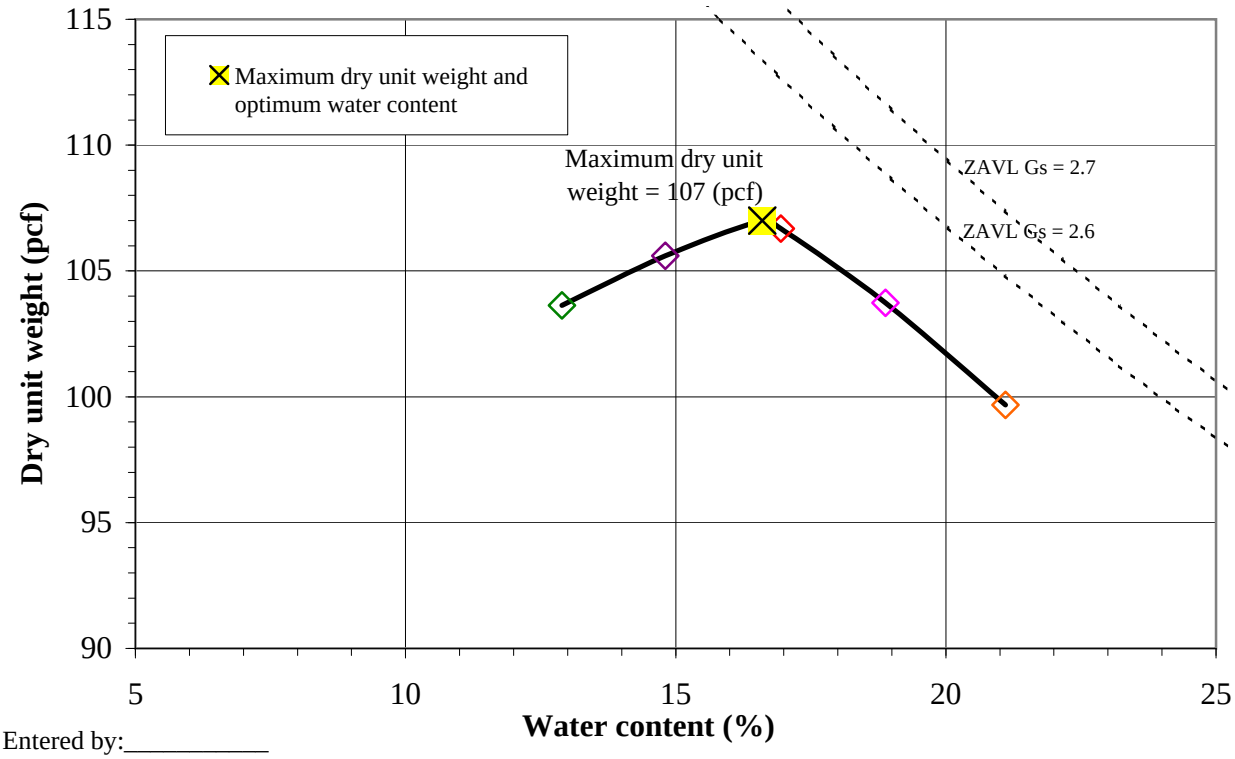
**Boring No.:** WUA-TP003-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 2
Mold volume ($ft^3$): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 16.6
**Maximum dry unit weight (pcf):** 107

| Point Number | +8% | +10% | +6% | +12% | +14% | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 5988.2 | 6041.3 | 5924.3 | 6019.6 | 5980.3 | | | |
| Wt. of Mold (g) | 4160.1 | 4160.1 | 4160.1 | 4160.1 | 4160.1 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 121.2 | 124.8 | 117.0 | 123.3 | 120.7 | | | |
| Wet Soil + Tare (g) | 866.98 | 843.94 | 686.43 | 765.24 | 862.82 | | | |
| Dry Soil + Tare (g) | 770.44 | 740.20 | 622.12 | 665.90 | 734.68 | | | |
| Tare (g) | 118.56 | 127.94 | 123.43 | 139.73 | 127.41 | | | |
| Water Content, w (%) | **14.8** | **16.9** | **12.9** | **18.9** | **21.1** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **105.6** | **106.7** | **103.6** | **103.7** | **99.7** | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/21/2013
By: MP/DKS

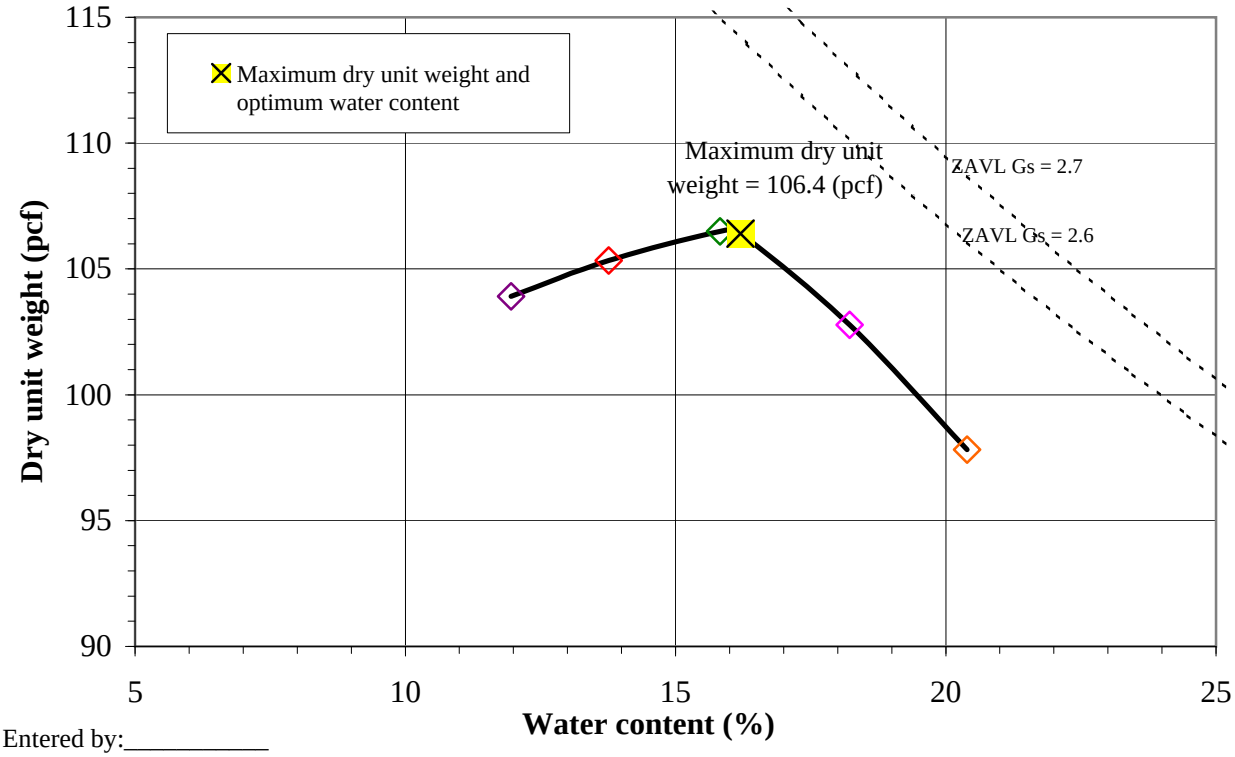
**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 2
Mold volume ($ft^3$): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 16.2
**Maximum dry unit weight (pcf):** 106.4

| Point Number | +6% | +8% | +10% | +12% | +14% | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 5914.3 | 5967.1 | 6019.8 | 5992.2 | 5936.0 | | | |
| Wt. of Mold (g) | 4160.1 | 4160.1 | 4160.1 | 4160.1 | 4160.1 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 116.3 | 119.8 | 123.3 | 121.5 | 117.8 | | | |
| Wet Soil + Tare (g) | 793.31 | 785.16 | 729.94 | 720.77 | 811.93 | | | |
| Dry Soil + Tare (g) | 721.64 | 705.54 | 647.18 | 631.53 | 704.92 | | | |
| Tare (g) | 122.18 | 127.09 | 124.09 | 141.72 | 180.27 | | | |
| Water Content, w (%) | **12.0** | **13.8** | **15.8** | **18.2** | **20.4** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **103.9** | **105.3** | **106.5** | **102.8** | **97.8** | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/21/2013
By: BRR/DKS

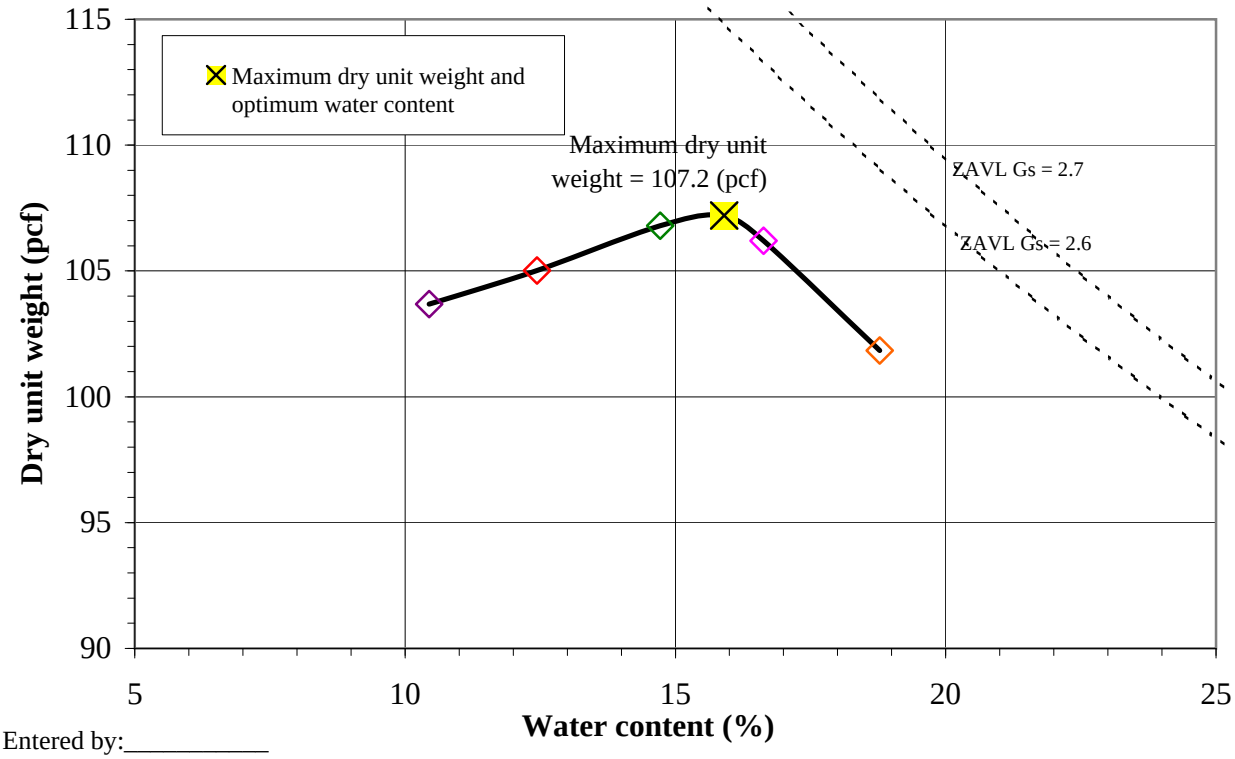
**Boring No.:** WUA-TP005-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 3
Mold volume ($ft^3$): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 15.9
**Maximum dry unit weight (pcf):** 107.2

| Point Number | +4% | +6% | +8% | +10% | +12% | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 5895.4 | 5949.1 | 6015.9 | 6036.1 | 5992.4 | | | |
| Wt. of Mold (g) | 4169.7 | 4169.7 | 4169.7 | 4169.7 | 4169.7 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 114.5 | 118.1 | 122.5 | 123.9 | 121.0 | | | |
| Wet Soil + Tare (g) | 877.44 | 816.01 | 868.81 | 804.39 | 907.87 | | | |
| Dry Soil + Tare (g) | 815.25 | 750.77 | 784.50 | 715.24 | 784.48 | | | |
| Tare (g) | 219.83 | 226.30 | 211.70 | 179.20 | 127.34 | | | |
| Water Content, w (%) | **10.4** | **12.4** | **14.7** | **16.6** | **18.8** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **103.7** | **105.0** | **106.8** | **106.2** | **101.8** | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/8/2013
By: ET

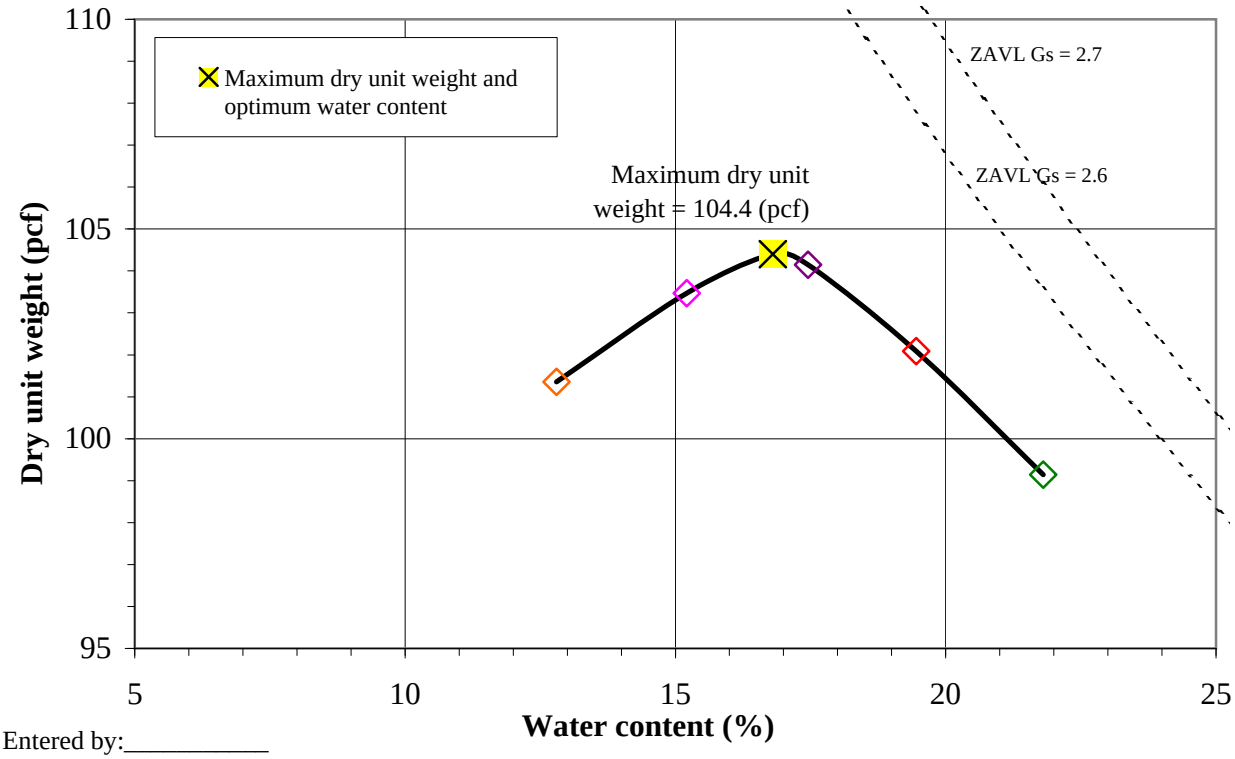
**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 1
Mold volume ($ft^3$): 0.0333

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 16.8
**Maximum dry unit weight (pcf):** 104.4

| Point Number | +4% | +6% | +8% | +2% | As Is | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 6092.6 | 6086.9 | 6068.9 | 6045.5 | 5971.9 | | | |
| Wt. of Mold (g) | 4245.5 | 4245.5 | 4245.5 | 4245.5 | 4245.5 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 122.3 | 121.9 | 120.8 | 119.2 | 114.3 | | | |
| Wet Soil + Tare (g) | 722.48 | 636.60 | 623.79 | 729.81 | 633.94 | | | |
| Dry Soil + Tare (g) | 633.59 | 553.79 | 539.10 | 662.84 | 575.98 | | | |
| Tare (g) | 124.34 | 128.08 | 150.65 | 222.53 | 123.25 | | | |
| Water Content, w (%) | **17.5** | **19.5** | **21.8** | **15.2** | **12.8** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **104.1** | **102.1** | **99.1** | **103.5** | **101.4** | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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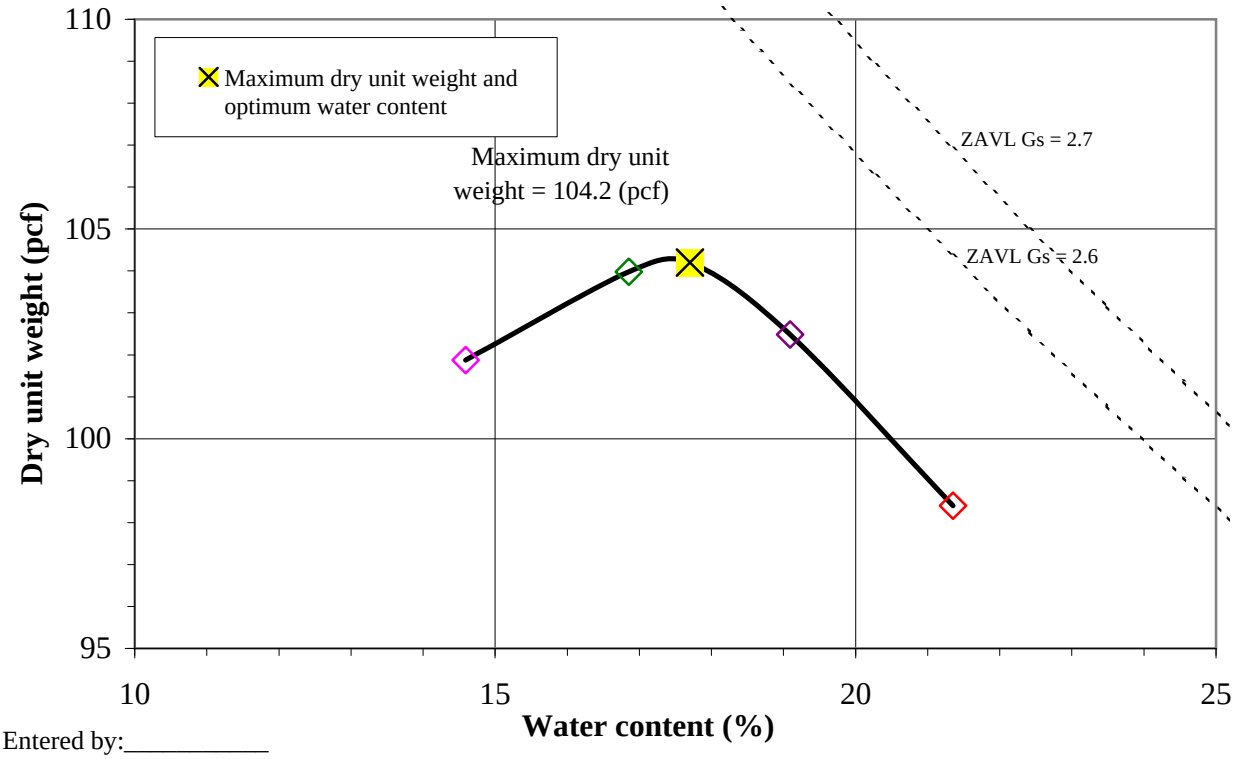
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/8/2013
By: ET

Method: ASTM D698 B
Mold Id. Inc 3
Mold volume ($ft^3$): 0.0332

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
As-received water content (%): Not requested
Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 17.7
**Maximum dry unit weight (pcf):** 104.2

| Point Number | +10% | +12% | +8% | +6% | | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 6008.9 | 5969.1 | 6000.7 | 5928.8 | | | | |
| Wt. of Mold (g) | 4169.7 | 4169.7 | 4169.7 | 4169.7 | | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 122.1 | 119.4 | 121.5 | 116.7 | | | | |
| Wet Soil + Tare (g) | 750.80 | 683.42 | 649.06 | 663.82 | | | | |
| Dry Soil + Tare (g) | 664.27 | 594.80 | 573.97 | 595.63 | | | | |
| Tare (g) | 210.99 | 179.73 | 128.42 | 128.20 | | | | |
| Water Content, w (%) | **19.1** | **21.4** | **16.9** | **14.6** | | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **102.5** | **98.4** | **104.0** | **101.9** | | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/11/2013
By: MP

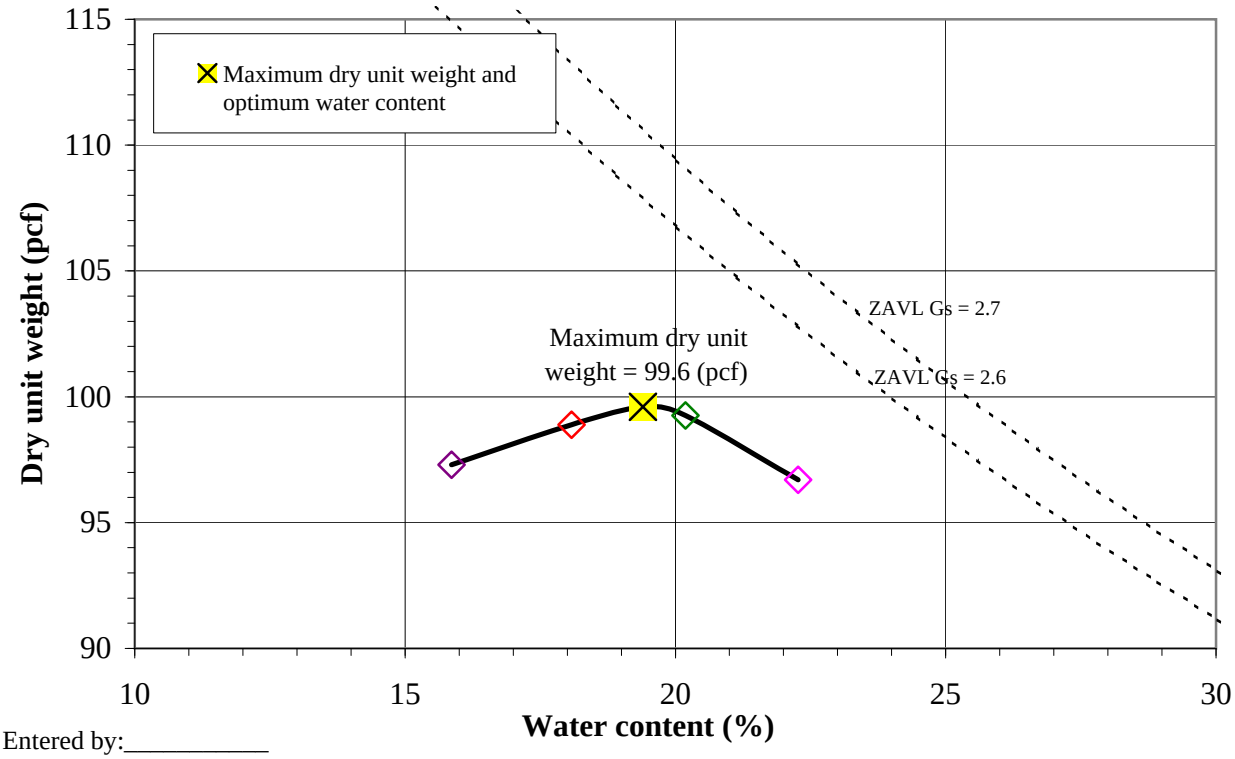
**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 1
Mold volume ($ft^3$): 0.0333

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 19.4
**Maximum dry unit weight (pcf):** 99.6

| Point Number | +6% | +8% | +10% | +12% | | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 5947.5 | 6008.6 | 6046.7 | 6030.8 | | | | |
| Wt. of Mold (g) | 4245.4 | 4245.4 | 4245.4 | 4245.4 | | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 112.7 | 116.8 | 119.3 | 118.2 | | | | |
| Wet Soil + Tare (g) | 793.10 | 730.81 | 657.43 | 631.47 | | | | |
| Dry Soil + Tare (g) | 702.11 | 637.30 | 567.80 | 538.32 | | | | |
| Tare (g) | 128.38 | 120.00 | 123.83 | 120.08 | | | | |
| Water Content, w (%) | 15.9 | 18.1 | 20.2 | 22.3 | | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | 97.3 | 98.9 | 99.3 | 96.7 | | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/11/2013
By: MP

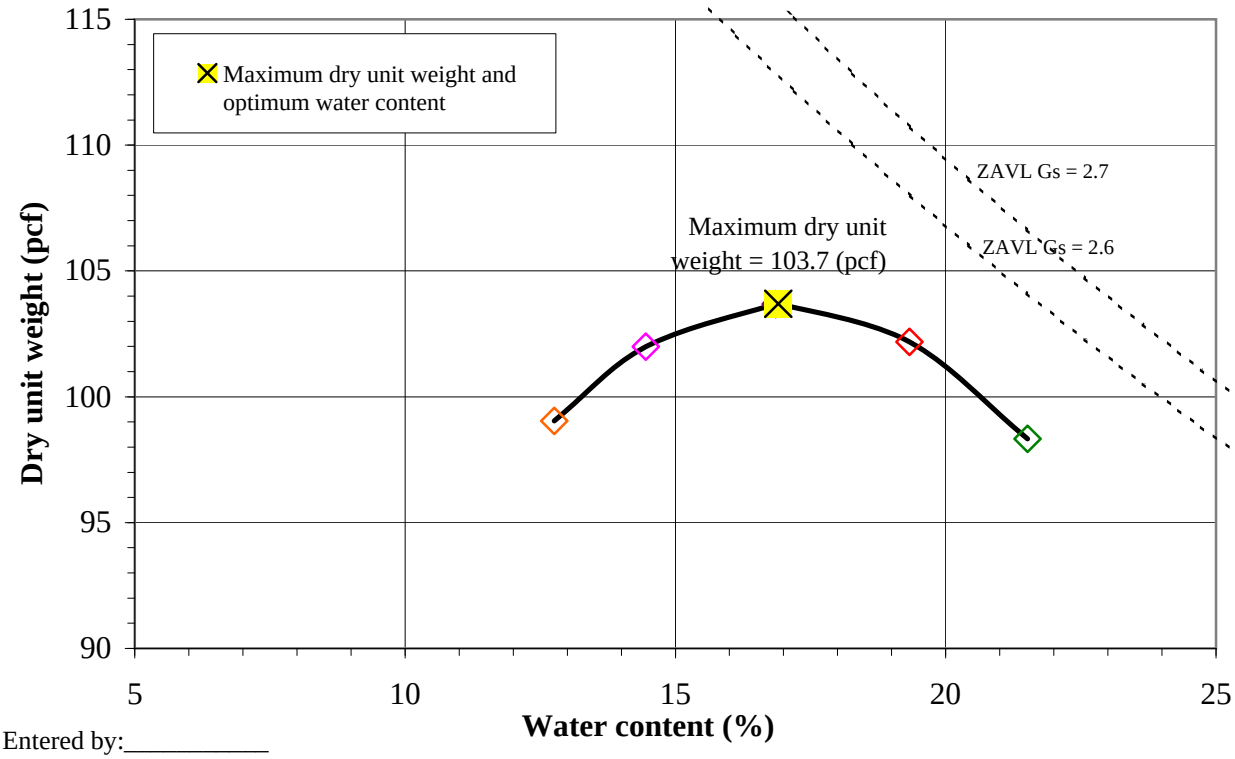
**Boring No.:** WUA-TP009-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 1
Mold volume ($ft^3$): 0.0333

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 16.9
**Maximum dry unit weight (pcf):** 103.7

| Point Number | +8% | +10% | +12% | +6% | +4% | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 6074.9 | 6086.5 | 6049.5 | 6008.0 | 5931.7 | | | |
| Wt. of Mold (g) | 4245.4 | 4245.4 | 4245.4 | 4245.4 | 4245.4 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 121.2 | 121.9 | 119.5 | 116.7 | 111.7 | | | |
| Wet Soil + Tare (g) | 596.34 | 653.19 | 684.40 | 585.10 | 677.28 | | | |
| Dry Soil + Tare (g) | 528.63 | 567.41 | 584.85 | 527.23 | 626.00 | | | |
| Tare (g) | 126.90 | 123.67 | 122.09 | 126.80 | 224.06 | | | |
| Water Content, w (%) | **16.9** | **19.3** | **21.5** | **14.5** | **12.8** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **103.7** | **102.2** | **98.3** | **102.0** | **99.0** | | | |

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# Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/11/2013
By: MP

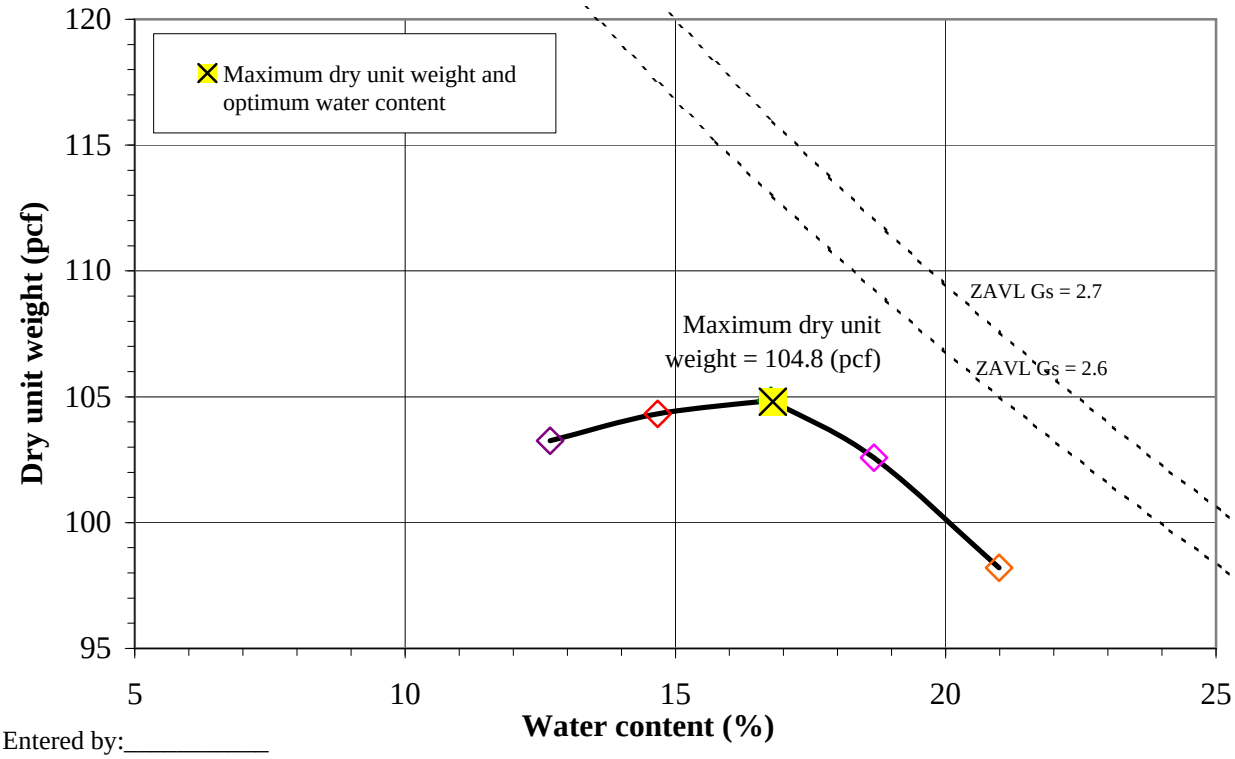
**Boring No.:** WUA-TP010-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 1
Mold volume ($ft^3$): 0.0333

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

**Optimum water content (%):** 16.8
**Maximum dry unit weight (pcf):** 104.8

| Point Number | +6% | +8% | +10% | +12% | +14% | | | |
|---|---|---|---|---|---|---|---|---|
| Wt. Sample + Mold (g) | 6002.2 | 6051.8 | 6093.8 | 6083.6 | 6039.4 | | | |
| Wt. of Mold (g) | 4245.4 | 4245.4 | 4245.4 | 4245.4 | 4245.4 | | | |
| Wet Unit Wt., $\gamma_m$ (pcf) | 116.3 | 119.6 | 122.4 | 121.7 | 118.8 | | | |
| Wet Soil + Tare (g) | 609.52 | 667.87 | 818.15 | 672.08 | 834.00 | | | |
| Dry Soil + Tare (g) | 554.23 | 598.85 | 718.44 | 586.69 | 726.05 | | | |
| Tare (g) | 118.33 | 128.44 | 123.65 | 129.44 | 211.70 | | | |
| Water Content, w (%) | **12.7** | **14.7** | **16.8** | **18.7** | **21.0** | | | |
| Dry Unit Wt., $\gamma_d$ (pcf) | **103.3** | **104.3** | **104.8** | **102.6** | **98.2** | | | |

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# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/19/2013
By: JDF

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Sample Type: Laboratory Compacted
Compaction Specifications: 85 (%) Dry unit weight
at 8.5 (%) w

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 3.012 | 3.006 |
| Sample Diameter, D (in) | 2.406 | 2.39 |
| Sample Length, L (cm) | 7.650 | 7.634 |
| Sample Area, A (cm^2) | 29.332 | 29.017 |
| Sample Volume, V (cm^3) | 224.41 | 221.52 |
| Wt. Rings + Wet Soil (g) | 354.02 | 423.13 |
| Wt. Rings (g) | 0 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 98.5 | 119.2 |
| Wet Soil + Tare (g) | 251.73 | 551.68 |
| Dry Soil + Tare (g) | 242.16 | 455.37 |
| Tare (g) | 126.81 | 128.2 |
| Weight of solids, Ws (g) | 326.90 | 326.90 |
| Water Content, w (%) | 8.30 | 29.44 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 90.9 | 92.1 |
| Void ratio, e, for assumed Gs | 0.83 | 0.79 |
| Saturation (%), for assumed Gs | 26.6 | 100 [a] |
| **Average K[b] (cm/sec)** | **3.3E-05** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Optimum water content (%) | 17.5 | |
| Maximum dry unit weight (pcf) | 106.9 | |
| Gs | 2.67 | Assumed |
| Cell No. | 2 | |
| Station No. | 1 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 30 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.86 | 0.96 |
| External Burette ($cm^3$) | 8.30 | 16.70 |
| Cell Pressure (psi) | 0.0 | 35.0 |
| Backpressure bottom (psi) | 30.0 | |
| Backpressure top (psi) | 30.0 | |
| System volume coefficient ($cm^3$/psi) | 0.158 | |
| System volume change ($cm^3$) | 5.52 | |
| Net sample volume change ($cm^3$) | -2.88 | |
| Bottom burette ground length, $l_b$ (cm) | 82.00 | |
| Top burette ground length, $l_t$ (cm) | 82.1 | |
| Burette area, a ($cm^2$) | 0.197 | |
| Conversion, reading to cm head (cm/rd) | 5.076 | |

Start Date and Time: 11/15/13 9:11

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 1080.0 | 1.20<br>4.12 | 8.72<br>5.80 | 38.07 | 8.43 | 3.6E-05 | 22.4 | 0.94 | 3.4E-05 |
| 1260.0 | 0.38<br>4.18 | 9.62<br>5.80 | 46.80 | 8.12 | 3.6E-05 | 22.8 | 0.93 | 3.4E-05 |
| 1020.0 | 0.42<br>3.78 | 9.54<br>6.20 | 46.19 | 12.18 | 3.4E-05 | 21.5 | 0.96 | 3.3E-05 |
| 960.0 | 0.44<br>3.70 | 9.54<br>6.28 | 46.09 | 13.00 | 3.4E-05 | 21.5 | 0.96 | 3.3E-05 |
| 60.0 | 0.00<br>0.40 | 10.00<br>9.60 | 50.66 | 46.60 | 3.6E-05 | 22.6 | 0.94 | 3.4E-05 |
| 960.0 | 0.40<br>3.70 | 9.60<br>6.28 | 46.60 | 13.00 | 3.4E-05 | 22.6 | 0.94 | 3.2E-05 |

Entered by:_____
Reviewed:_____

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# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/19/2013
By: JDF

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Sample Type: Laboratory Compacted
Compaction Specifications: 85 (%) Dry unit weight
at 9.0 (%) w

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 3.011 | 3.000 |
| Sample Diameter, D (in) | 2.403 | 2.38 |
| Sample Length, L (cm) | 7.648 | 7.619 |
| Sample Area, A (cm^2) | 29.259 | 28.709 |
| Sample Volume, V (cm^3) | 223.77 | 218.74 |
| Wt. Rings + Wet Soil (g) | 1111.29 | 423.74 |
| Wt. Rings (g) | 758.93 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 98.3 | 120.9 |
| Wet Soil + Tare (g) | 328.04 | 535.3 |
| Dry Soil + Tare (g) | 312.2 | 436.67 |
| Tare (g) | 139.72 | 121.57 |
| Weight of solids, Ws (g) | 322.72 | 322.72 |
| Water Content, w (%) | 9.18 | 31.30 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 90.0 | 92.1 |
| Void ratio, e, for assumed Gs | 0.85 | 0.84 |
| Saturation (%), for assumed Gs | 28.8 | 100 [a] |
| **Average K[b] (cm/sec)** | **1.4E-04** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Optimum water content (%) | 16.2 | |
| Maximum dry unit weight (pcf) | 106.4 | |
| Gs | 2.67 | Assumed |
| Cell No. | T1 | |
| Station No. | 2 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 30 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.94 | 0.98 |
| External Burette ($cm^3$) | 12.20 | 21.40 |
| Cell Pressure (psi) | 0.0 | 35.0 |

| | |
|---|---|
| Backpressure bottom (psi) | 30.0 |
| Backpressure top (psi) | 30.0 |
| System volume coefficient ($cm^3$/psi) | 0.119 |
| System volume change ($cm^3$) | 4.17 |
| Net sample volume change ($cm^3$) | -5.03 |
| Bottom burette ground length, $l_b$ (cm) | 81.99 |
| Top burette ground length, $l_t$ (cm) | 81.97 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 11/18/13 8:40

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 60.0 | 0.00<br>1.48 | 10.00<br>8.56 | 50.78 | 35.96 | 1.5E-04 | 22.0 | 0.95 | 1.4E-04 |
| 240.0 | 1.48<br>4.12 | 8.56<br>5.98 | 35.96 | 9.46 | 1.5E-04 | 22.1 | 0.95 | 1.4E-04 |
| 60.0 | 0.00<br>1.44 | 10.00<br>8.54 | 50.78 | 36.06 | 1.5E-04 | 21.0 | 0.98 | 1.5E-04 |
| 240.0 | 1.44<br>4.10 | 8.54<br>5.92 | 36.06 | 9.26 | 1.5E-04 | 20.8 | 0.98 | 1.5E-04 |
| 60.0 | 0.00<br>1.42 | 10.00<br>8.56 | 50.78 | 36.26 | 1.5E-04 | 22.9 | 0.93 | 1.4E-04 |
| 240.0 | 1.42<br>4.10 | 8.56<br>5.90 | 36.26 | 9.16 | 1.5E-04 | 21.9 | 0.95 | 1.4E-04 |

Entered by:_____
Reviewed:_____

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# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/19/2013
By: JDF

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silty clay
Sample Type: Laboratory Compacted
Compaction Specifications: 85 (%) Dry unit weight
at 8.5 (%) w

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 3.014 | 2.996 |
| Sample Diameter, D (in) | 2.401 | 2.36 |
| Sample Length, L (cm) | 7.656 | 7.610 |
| Sample Area, A (cm^2) | 29.211 | 28.322 |
| Sample Volume, V (cm^3) | 223.62 | 215.51 |
| Wt. Rings + Wet Soil (g) | 346.12 | 411.81 |
| Wt. Rings (g) | 0 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 96.6 | 119.3 |
| Wet Soil + Tare (g) | 304.54 | 534.21 |
| Dry Soil + Tare (g) | 289.91 | 440.58 |
| Tare (g) | 123.34 | 122.43 |
| Weight of solids, Ws (g) | 318.17 | 318.17 |
| Water Content, w (%) | 8.78 | 29.43 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 88.8 | 92.2 |
| Void ratio, e, for assumed Gs | 0.88 | 0.79 |
| Saturation (%), for assumed Gs | 26.8 | 100 [a] |
| **Average K[b] (cm/sec)** | **2.3E-05** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Optimum water content (%) | 16.8 | |
| Maximum dry unit weight (pcf) | 104.4 | |
| Gs | 2.67 | Assumed |
| Cell No. | T2 | |
| Station No. | 3 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 30 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.88 | 0.96 |
| External Burette ($cm^3$) | 10.50 | 22.40 |
| Cell Pressure (psi) | 0.0 | 35.0 |

| | |
|---|---|
| Backpressure bottom (psi) | 30.0 |
| Backpressure top (psi) | 30.0 |
| System volume coefficient ($cm^3$/psi) | 0.108 |
| System volume change ($cm^3$) | 3.79 |
| Net sample volume change ($cm^3$) | -8.11 |
| Bottom burette ground length, $l_b$ (cm) | 82.10 |
| Top burette ground length, $l_t$ (cm) | 81.9 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 11/15/13 9:12

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 180.0 | 0.00<br>0.76 | 10.00<br>9.20 | 50.96 | 43.04 | 2.5E-05 | 22.2 | 0.95 | 2.4E-05 |
| 1080.0 | 0.76<br>3.42 | 9.20<br>6.54 | 43.04 | 16.04 | 2.4E-05 | 21.8 | 0.96 | 2.3E-05 |
| 600.0 | 3.42<br>4.10 | 6.54<br>5.86 | 16.04 | 9.13 | 2.5E-05 | 21.2 | 0.97 | 2.4E-05 |
| 60.0 | 0.00<br>0.28 | 10.00<br>9.78 | 50.96 | 48.42 | 2.3E-05 | 22.1 | 0.95 | 2.1E-05 |
| 1320.0 | 0.28<br>3.56 | 9.78<br>6.54 | 48.42 | 15.33 | 2.3E-05 | 22.5 | 0.94 | 2.2E-05 |
| 60.0 | 0.00<br>0.26 | 10.00<br>9.72 | 50.96 | 48.22 | 2.4E-05 | 21.0 | 0.98 | 2.4E-05 |
| 900.0 | 0.26<br>2.86 | 9.72<br>7.12 | 48.22 | 21.82 | 2.3E-05 | 22.0 | 0.95 | 2.2E-05 |

Entered by:_____
Reviewed:_____

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# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/19/2013
By: JDF

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Sample Type: Laboratory Compacted
Compaction Specifications: 85 (%) Dry unit weight
at 8.5 (%) w

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 3.007 | 2.993 |
| Sample Diameter, D (in) | 2.409 | 2.38 |
| Sample Length, L (cm) | 7.638 | 7.603 |
| Sample Area, A (cm^2) | 29.406 | 28.735 |
| Sample Volume, V (cm^3) | 224.59 | 218.48 |
| Wt. Rings + Wet Soil (g) | 345.51 | 418.30 |
| Wt. Rings (g) | 0 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 96.0 | 119.5 |
| Wet Soil + Tare (g) | 304.93 | 545.67 |
| Dry Soil + Tare (g) | 291.11 | 446.57 |
| Tare (g) | 123 | 127.09 |
| Weight of solids, Ws (g) | 319.26 | 319.26 |
| Water Content, w (%) | 8.22 | 31.02 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 88.7 | 91.2 |
| Void ratio, e, for assumed Gs | 0.86 | 0.82 |
| Saturation (%), for assumed Gs | 25.2 | 100 [a] |
| **Average K[b] (cm/sec)** | **5.8E-05** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Optimum water content (%) | 17.7 | |
| Maximum dry unit weight (pcf) | 104.2 | |
| Gs | 2.65 | Assumed |
| Cell No. | T3 | |
| Station No. | 4 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 30 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.84 | 1.00 |
| External Burette ($cm^3$) | 7.30 | 17.10 |
| Cell Pressure (psi) | 0.0 | 35.0 |

| | |
|---|---|
| Backpressure bottom (psi) | 30.0 |
| Backpressure top (psi) | 30.0 |
| System volume coefficient ($cm^3$/psi) | 0.105 |
| System volume change ($cm^3$) | 3.69 |
| Net sample volume change ($cm^3$) | -6.11 |
| Bottom burette ground length, $l_b$ (cm) | 81.90 |
| Top burette ground length, $l_t$ (cm) | 81.98 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 11/15/13 9:34

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 600.0 | 0.90<br>3.96 | 9.14<br>6.12 | 41.75 | 10.88 | 5.8E-05 | 21.6 | 0.96 | 5.6E-05 |
| 660.0 | 0.80<br>4.04 | 9.20<br>6.00 | 42.56 | 9.87 | 5.8E-05 | 22.5 | 0.94 | 5.4E-05 |
| 60.0 | 0.00<br>0.70 | 10.00<br>9.30 | 50.68 | 43.57 | 6.6E-05 | 22.5 | 0.94 | 6.2E-05 |
| 600.0 | 0.70<br>3.94 | 9.30<br>6.04 | 43.57 | 10.58 | 6.1E-05 | 22.5 | 0.94 | 5.8E-05 |
| 60.0 | 0.00<br>0.72 | 10.00<br>9.38 | 50.68 | 43.88 | 6.3E-05 | 22.6 | 0.94 | 5.9E-05 |
| 600.0 | 0.72<br>4.00 | 9.38<br>5.90 | 43.88 | 9.56 | 6.6E-05 | 22.6 | 0.94 | 6.2E-05 |

Entered by:_____
Reviewed:_____

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# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/19/2013
By: JDF

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Sample Description: Brown silt
Sample Type: Laboratory Compacted
Compaction Specifications: 85 (%) Dry unit weight
at 8.5 (%) w

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 3.010 | 2.998 |
| Sample Diameter, D (in) | 2.405 | 2.38 |
| Sample Length, L (cm) | 7.645 | 7.615 |
| Sample Area, A (cm^2) | 29.308 | 28.727 |
| Sample Volume, V (cm^3) | 224.07 | 218.77 |
| Wt. Rings + Wet Soil (g) | 330.21 | 410.65 |
| Wt. Rings (g) | 0 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 92.0 | 117.2 |
| Wet Soil + Tare (g) | 379.66 | 536.54 |
| Dry Soil + Tare (g) | 360.76 | 430.39 |
| Tare (g) | 140.47 | 127.37 |
| Weight of solids, Ws (g) | 304.12 | 304.12 |
| Water Content, w (%) | 8.58 | 35.03 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 84.7 | 86.8 |
| Void ratio, e, for assumed Gs | 0.95 | 0.93 |
| Saturation (%), for assumed Gs | 23.9 | 100 [a] |
| **Average K[b] (cm/sec)** | **7.8E-05** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Optimum water content (%) | 19.4 | |
| Maximum dry unit weight (pcf) | 99.6 | |
| Gs | 2.65 | Assumed |
| Cell No. | 3 | |
| Station No. | 5 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 30 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.86 | 0.98 |
| External Burette ($cm^3$) | 12.60 | 23.20 |
| Cell Pressure (psi) | 0.0 | 35.0 |

| | |
|---|---|
| Backpressure bottom (psi) | 30.0 |
| Backpressure top (psi) | 30.0 |
| System volume coefficient ($cm^3$/psi) | 0.151 |
| System volume change ($cm^3$) | 5.29 |
| Net sample volume change ($cm^3$) | -5.31 |
| Bottom burette ground length, $l_b$ (cm) | 81.85 |
| Top burette ground length, $l_t$ (cm) | 81.9 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 11/15/13 9:35

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 420.0 | 1.68<br>4.12 | 8.30<br>5.84 | 33.55 | 8.68 | 8.4E-05 | 21.0 | 0.98 | 8.2E-05 |
| 480.0 | 0.96<br>4.10 | 9.06<br>5.94 | 41.07 | 9.29 | 8.1E-05 | 22.1 | 0.95 | 7.7E-05 |
| 480.0 | 0.92<br>4.06 | 9.08<br>5.96 | 41.37 | 9.59 | 7.9E-05 | 21.2 | 0.97 | 7.7E-05 |
| 480.0 | 0.92<br>4.05 | 9.06<br>5.94 | 41.27 | 9.54 | 8.0E-05 | 21.0 | 0.98 | 7.8E-05 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Entered by:_____
Reviewed:_____

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# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/2/2013
By: JDF

**Boring No.:** SB-7
**Sample:**
**Depth:** 6-8'
Sample Description: light brown silt
Sample Type: Undisturbed

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 2.770 | 2.767 |
| Sample Diameter, D (in) | 2.884 | 2.88 |
| Sample Length, L (cm) | 7.036 | 7.027 |
| Sample Area, A (cm^2) | 42.145 | 41.907 |
| Sample Volume, V (cm^3) | 296.52 | 294.49 |
| Wt. Rings + Wet Soil (g) | 628.36 | 571.21 |
| Wt. Rings (g) | 152.04 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 100.3 | 121.1 |
| Wet Soil + Tare (g) | 296.8 | 689.62 |
| Dry Soil + Tare (g) | 287.4 | 568.94 |
| Tare (g) | 128.47 | 122.22 |
| Weight of solids, Ws (g) | 449.72 | 449.72 |
| Water Content, w (%) | 5.91 | 27.01 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 94.7 | 95.3 |
| Void ratio, e, for assumed Gs | 0.75 | 0.72 |
| Saturation (%), for assumed Gs | 21.0 | 100 [a] |
| **Average K[b] (cm/sec)** | **6.2E-05** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Gs | 2.65 | Assumed |
| Cell No. | 1 | |
| Station No. | 1 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 49.5 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.54 | 0.96 |
| External Burette ($cm^3$) | 9.90 | 20.10 |
| Cell Pressure (psi) | 0.0 | 54.5 |

| | |
|---|---|
| Backpressure bottom (psi) | 49.5 |
| Backpressure top (psi) | 49.5 |
| System volume coefficient ($cm^3$/psi) | 0.150 |
| System volume change ($cm^3$) | 8.16 |
| Net sample volume change ($cm^3$) | -2.04 |
| Bottom burette ground length, $l_b$ (cm) | 82.00 |
| Top burette ground length, $l_t$ (cm) | 82.1 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 11/27/13 12:26

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 180.0 | 0.00<br>2.56 | 10.00<br>7.42 | 50.66 | 24.57 | 6.6E-05 | 23.6 | 0.92 | 6.1E-05 |
| 180.0 | 0.00<br>2.58 | 10.00<br>7.42 | 50.66 | 24.47 | 6.7E-05 | 23.6 | 0.92 | 6.1E-05 |
| 180.0 | 0.00<br>2.64 | 10.00<br>7.35 | 50.66 | 23.81 | 6.9E-05 | 23.6 | 0.92 | 6.4E-05 |
| 180.0 | 0.00<br>2.64 | 10.00<br>7.35 | 50.66 | 23.81 | 6.9E-05 | 23.6 | 0.92 | 6.4E-05 |
| | | | | | | | | |
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Entered by:_____
Reviewed:_____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

© IGES 2005, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/16/2013
By: JDF

**Boring No.:** SB7
**Sample:**
**Depth:** 12-14'
Sample Description: Light brown silt
Sample Type: Undisturbed

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 4.443 | 4.429 |
| Sample Diameter, D (in) | 2.798 | 2.76 |
| Sample Length, L (cm) | 11.285 | 11.249 |
| Sample Area, A (cm^2) | 39.669 | 38.653 |
| Sample Volume, V (cm^3) | 447.67 | 434.79 |
| Wt. Rings + Wet Soil (g) | 800.26 | 811.17 |
| Wt. Rings (g) | 168.6 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 88.1 | 116.5 |
| Wet Soil + Tare (g) | 405.17 | 1098.2 |
| Dry Soil + Tare (g) | 389.85 | 890.05 |
| Tare (g) | 128.62 | 311.06 |
| Weight of solids, Ws (g) | 596.67 | 596.67 |
| Water Content, w (%) | 5.86 | 35.95 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 83.2 | 85.7 |
| Void ratio, e, for assumed Gs | 0.99 | 0.95 |
| Saturation (%), for assumed Gs | 15.7 | 100 [a] |
| **Average K[b] (cm/sec)** | **3.1E-04** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Gs | 2.65 | Assumed |
| Cell No. | H1 | |
| Station No. | 1 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 35 | |
| Effective horiz. consolidation stress (psi) | 5 | |
| Effective vert. consolidation stress (psi) | 5 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.56 | 0.98 |
| External Burette ($cm^3$) | 8.80 | 29.90 |
| Cell Pressure (psi) | 0.0 | 40.0 |

| | |
|---|---|
| Backpressure bottom (psi) | 35.0 |
| Backpressure top (psi) | 35.0 |
| System volume coefficient ($cm^3$/psi) | 0.205 |
| System volume change ($cm^3$) | 8.22 |
| Net sample volume change ($cm^3$) | -12.88 |
| Bottom burette ground length, $l_b$ (cm) | 82.00 |
| Top burette ground length, $l_t$ (cm) | 82.1 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 12/13/13 7:24

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 180.0 | 0.00<br>4.32 | 10.00<br>5.64 | 50.66 | 6.60 | 3.2E-04 | 21.8 | 0.96 | 3.1E-04 |
| 180.0 | 0.00<br>4.32 | 10.00<br>5.66 | 50.66 | 6.70 | 3.2E-04 | 21.7 | 0.96 | 3.1E-04 |
| 180.0 | 0.00<br>4.34 | 10.00<br>5.66 | 50.66 | 6.60 | 3.2E-04 | 22.6 | 0.94 | 3.0E-04 |
| 180.0 | 0.00<br>4.36 | 10.00<br>5.64 | 50.66 | 6.40 | 3.3E-04 | 23.1 | 0.93 | 3.1E-04 |
| | | | | | | | | |
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Entered by:_____
Reviewed:_____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

© IGES 2005, 2013

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/17/2013
By: NB/JDF

**Boring No.:** SB3
**Sample:**
**Depth:**
Sample Description: Light brown silt with gravel and sand
Sample Type: Remolded
Compaction Specifications: 105.4 pcf
at 0 (%) w

| | Initial (o) | Final (f) |
|---|---|---|
| Sample Height, H (in) | 2.471 | 2.436 |
| Sample Diameter, D (in) | 2.387 | 2.32 |
| Sample Length, L (cm) | 6.276 | 6.188 |
| Sample Area, A (cm^2) | 28.871 | 27.253 |
| Sample Volume, V (cm^3) | 181.20 | 168.65 |
| Wt. Rings + Wet Soil (g) | 305.97 | 362.76 |
| Wt. Rings (g) | 0 | 0 |
| Wet Unit Wt., $\gamma_m$ (pcf) | 105.4 | 134.3 |
| Wet Soil + Tare (g) | 1 | 489.34 |
| Dry Soil + Tare (g) | 1 | 432.79 |
| Tare (g) | 0 | 128.09 |
| Weight of solids, Ws (g) | 305.97 | 305.97 |
| Water Content, w (%) | 0.00 | 18.56 |
| Dry Unit Wt, $\gamma_d$ (pcf) | 105.4 | 113.3 |
| Void ratio, e, for assumed Gs | 0.57 | 0.49 |
| Saturation (%), for assumed Gs | 0.0 | 100 [a] |
| **Average K[b] (cm/sec)** | **2.6E-06** | |

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

| | | |
|---|---|---|
| Gs | 2.65 | Assumed |
| Cell No. | 3 | |
| Station No. | 3 | |
| Permeant liquid used | De-aired tap water | |
| Total backpressure (psi) | 30 | |
| Effective horiz. consolidation stress (psi) | 11.3 | |
| Effective vert. consolidation stress (psi) | 11.3 | |

| | Initial (o) | Final (f) |
|---|---|---|
| B value | 0.98 | 1.00 |
| External Burette ($cm^3$) | 14.50 | 33.30 |
| Cell Pressure (psi) | 0.0 | 41.3 |

| | |
|---|---|
| Backpressure bottom (psi) | 30.0 |
| Backpressure top (psi) | 30.0 |
| System volume coefficient ($cm^3$/psi) | 0.151 |
| System volume change ($cm^3$) | 6.25 |
| Net sample volume change ($cm^3$) | -12.55 |
| Bottom burette ground length, $l_b$ (cm) | 82.10 |
| Top burette ground length, $l_t$ (cm) | 81.9 |
| Burette area, a ($cm^2$) | 0.197 |
| Conversion, reading to cm head (cm/rd) | 5.076 |

Start Date and Time: 12/16/13 8:32

| Elapsed time (sec) | Bottom Burette ($cm^3$) | Top Burette ($cm^3$) | $h_1$ (cm) | $h_2$ (cm) | K (cm/sec) | Temp (ºC) | Visc. Ratio $R_f$ | K[b] (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| 1620.0 | 0.00<br>0.94 | 10.00<br>9.02 | 50.96 | 41.22 | 2.9E-06 | 22.8 | 0.93 | 2.7E-06 |
| 5160.0 | 0.94<br>2.84 | 9.02<br>7.12 | 41.22 | 21.93 | 2.7E-06 | 21.9 | 0.95 | 2.6E-06 |
| 3600.0 | 2.84<br>3.62 | 7.12<br>6.36 | 21.93 | 14.11 | 2.7E-06 | 22.3 | 0.95 | 2.6E-06 |
| 4560.0 | 3.62<br>4.20 | 6.36<br>5.78 | 14.11 | 8.22 | 2.6E-06 | 22.4 | 0.94 | 2.5E-06 |
| 1680.0 | 4.20<br>4.34 | 5.78<br>5.64 | 8.22 | 6.80 | 2.5E-06 | 22.5 | 0.94 | 2.4E-06 |
| 960.0 | 0.00<br>0.48 | 10.00<br>9.42 | 50.96 | 45.58 | 2.6E-06 | 22.5 | 0.94 | 2.4E-06 |
| 5940.0 | 0.48<br>2.86 | 9.42<br>7.12 | 45.58 | 21.82 | 2.8E-06 | 22.7 | 0.94 | 2.6E-06 |

Entered by:_____
Reviewed:_____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

## Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

**(In general accordance with ASTM D6836)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014
By: NB/MP

Specific gravity, Gs: 2.650 Assumed

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay
Sample type: Laboratory compacted
Dry unit weight 90.9 pcf
at 8.5 (%) w
Compaction specifications: 85% of ASTM D698B

| | | Test No. | 1 | 2 | 3 | 4 | 5 | 6 | 7* | 8* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tension (psi) | 0.5 | 1.0 | 2.0 | 6.0 | 18.0 | 72.0 | 1235.72 | 11655.23 |
| Sample A | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.1897 | 0.1872 |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 1.4720 | 1.4720 |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0002 | 0.0002 |
| | | Wt. rings/cup + wet soil (g) | 102.97 | 102.97 | 102.97 | 102.97 | 102.97 | 102.97 | 32.838 | 32.448 |
| | | Wt. rings/cup (g) | 43.33 | 43.33 | 43.33 | 43.33 | 43.33 | 43.33 | 24.598 | 24.578 |
| | | Moist soil, Ws (g) | 59.64 | 59.64 | 59.64 | 59.64 | 59.64 | 59.64 | 8.240 | 7.870 |
| | | Dry soil (g) | 55.07 | 55.07 | 55.07 | 55.07 | 55.07 | 55.07 | 7.683 | 7.587 |
| | | Moist unit wt., $\gamma_m$ (pcf) | 98.43 | 98.43 | 98.43 | 98.43 | 98.43 | 98.43 | 97.24 | 94.11 |
| | | Wet soil + tare (g) | 251.73 | 251.73 | 251.73 | 251.73 | 251.73 | 251.73 | 32.838 | 32.448 |
| | | Dry soil + tare (g) | 242.16 | 242.16 | 242.16 | 242.16 | 242.16 | 242.16 | 32.281 | 32.165 |
| | | Tare (g) | 126.81 | 126.81 | 126.81 | 126.81 | 126.81 | 126.81 | 24.598 | 24.578 |
| | | Moisture Content, w (%) | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 7.25 | 3.73 |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 90.89 | 90.89 | 90.89 | 90.89 | 90.89 | 90.89 | 90.66 | 90.73 |
| | Final Condition | Wet soil + ring/cup (g) | 116.74 | 115.88 | 114.20 | 109.96 | 107.35 | 105.41 | 32.831 | 32.445 |
| | | Dry soil + ring/cup (g) | 98.40 | 98.40 | 98.40 | 98.40 | 98.40 | 98.40 | 32.281 | 32.165 |
| | | Ring/cup (g) | 43.33 | 43.33 | 43.33 | 43.33 | 43.33 | 43.33 | 24.598 | 24.578 |
| | | Dry soil (g) | 55.07 | 55.07 | 55.07 | 55.07 | 55.07 | 55.07 | 7.683 | 7.587 |
| | | Moisture Content, w (%) | 33.30 | 31.74 | 28.69 | 20.99 | 16.25 | 12.73 | 7.16 | 3.69 |
| | | Volumetric Water Content, θ | 0.485 | 0.462 | 0.418 | 0.306 | 0.237 | 0.185 | 0.104 | 0.054 |
| Sample B | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | | |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | | |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | | |
| | | Wt. rings/cup + wet soil (g) | 102.40 | 102.40 | 102.40 | 102.40 | 102.40 | 102.40 | | |
| | | Wt. rings/cup (g) | 42.60 | 42.60 | 42.60 | 42.60 | 42.60 | 42.60 | | |
| | | Moist unit wt., $\gamma_m$ (pcf) | 98.70 | 98.70 | 98.70 | 98.70 | 98.70 | 98.70 | | |
| | | Wet soil + tare (g) | 251.73 | 251.73 | 251.73 | 251.73 | 251.73 | 251.73 | | |
| | | Dry soil + tare (g) | 242.16 | 242.16 | 242.16 | 242.16 | 242.16 | 242.16 | | |
| | | Tare (g) | 126.81 | 126.81 | 126.81 | 126.81 | 126.81 | 126.81 | | |
| | | Moisture Content, w (%) | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | | |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 91.13 | 91.13 | 91.13 | 91.13 | 91.13 | 91.13 | | |
| | Final Condition | Wet soil + ring/cup (g) | 116.01 | 114.81 | 113.80 | 109.78 | 107.12 | 105.19 | | |
| | | Dry soil + ring/cup (g) | 97.82 | 97.82 | 97.82 | 97.82 | 97.82 | 97.82 | | |
| | | Ring/cup (g) | 42.60 | 42.60 | 42.60 | 42.60 | 42.60 | 42.60 | | |
| | | Dry soil (g) | 55.22 | 55.22 | 55.22 | 55.22 | 55.22 | 55.22 | | |
| | | Moisture Content, w (%) | 32.94 | 30.77 | 28.94 | 21.66 | 16.84 | 13.35 | | |
| | | Volumetric Water Content, θ | 0.481 | 0.449 | 0.423 | 0.316 | 0.246 | 0.195 | | |
| | | **Average Volumetric Moisture:** | **0.483** | **0.456** | **0.420** | **0.311** | **0.241** | **0.190** | **0.104** | **0.054** |

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by:_____
Reviewed:_____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**Determination of the Soil Water Characteristic Curve for Desorption**

**Using Pressure Extractor**

**(In general accordance with ASTM D6836)**

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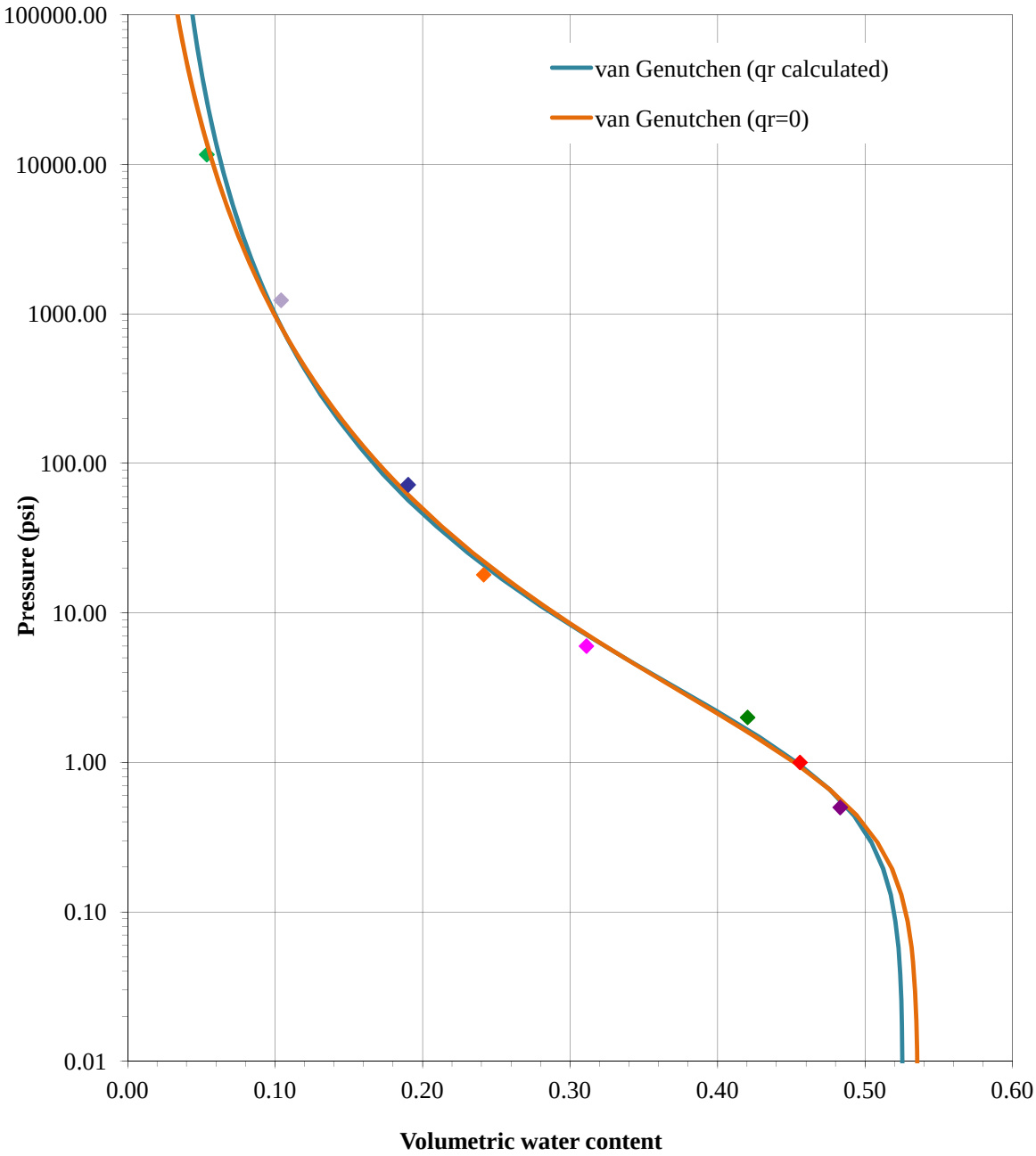
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014

**Boring No.:** WUA-TP001-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay




van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

| $\theta_r$ calculated | | Setting $\theta_r$ =0 | |
|---|---|---|---|
| $\theta_s$ | 0.5257 | $\theta_s$ | 0.5358 |
| $\theta_r$ | 0.0207 | $\theta_r$ | 0 |
| $\alpha$ | 1.0624 | $\alpha$ | 1.3558 |
| n | 1.2659 | n | 1.2337 |
| m | 0.2100 | m | 0.1894 |
| $R^2$ | 0.9963 | $R^2$ | 0.9960 |

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

**(In general accordance with ASTM D6836)**

© IGES 2014

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014
By: NB/MP

Specific gravity, Gs: 2.650 Assumed

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt
Sample type: Laboratory compacted
Dry unit weight 90.4 pcf
at 9 (%) w
Compaction specifications: 85% of ASTM D698B

| | | Test No. | 1 | 2 | 3 | 4 | 5 | 6 | 7* | 8* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tension (psi) | 0.5 | 1.0 | 2.0 | 6.0 | 18.0 | 72.0 | 929.69 | 11344.85 |
| Sample A | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.1897 | 0.1883 |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 1.4717 | 1.4718 |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0002 | 0.0002 |
| | | Wt. rings/cup + wet soil (g) | 102.56 | 102.56 | 102.56 | 102.56 | 102.56 | 102.56 | 32.694 | 32.139 |
| | | Wt. rings/cup (g) | 42.68 | 42.68 | 42.68 | 42.68 | 42.68 | 42.68 | 24.766 | 24.371 |
| | | Moist soil, Ws (g) | 59.88 | 59.88 | 59.88 | 59.88 | 59.88 | 59.88 | 7.928 | 7.768 |
| | | Dry soil (g) | 54.84 | 54.84 | 54.84 | 54.84 | 54.84 | 54.84 | 7.594 | 7.602 |
| | | Moist unit wt., $\gamma_m$ (pcf) | 98.83 | 98.83 | 98.83 | 98.83 | 98.83 | 98.83 | 93.60 | 92.37 |
| | | Wet soil + tare (g) | 328.04 | 328.04 | 328.04 | 328.04 | 328.04 | 328.04 | 32.694 | 32.139 |
| | | Dry soil + tare (g) | 312.20 | 312.20 | 312.20 | 312.20 | 312.20 | 312.20 | 32.360 | 31.973 |
| | | Tare (g) | 139.72 | 139.72 | 139.72 | 139.72 | 139.72 | 139.72 | 24.766 | 24.371 |
| | | Moisture Content, w (%) | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 4.40 | 2.18 |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 90.51 | 90.51 | 90.51 | 90.51 | 90.51 | 90.51 | 89.65 | 90.40 |
| | Final Condition | Wet soil + ring/cup (g) | 114.28 | 113.48 | 112.54 | 110.27 | 103.80 | 101.73 | 32.683 | 32.137 |
| | | Dry soil + ring/cup (g) | 97.52 | 97.52 | 97.52 | 97.52 | 97.52 | 97.52 | 32.360 | 31.973 |
| | | Ring/cup (g) | 42.68 | 42.68 | 42.68 | 42.68 | 42.68 | 42.68 | 24.766 | 24.371 |
| | | Dry soil (g) | 54.84 | 54.84 | 54.84 | 54.84 | 54.84 | 54.84 | 7.594 | 7.602 |
| | | Moisture Content, w (%) | 30.55 | 29.09 | 27.38 | 23.24 | 11.44 | 7.67 | 4.25 | 2.16 |
| | | Volumetric Water Content, θ | 0.443 | 0.422 | 0.397 | 0.337 | 0.166 | 0.111 | 0.061 | 0.031 |
| Sample B | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | | |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | | |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | | |
| | | Wt. rings/cup + wet soil (g) | 102.75 | 102.75 | 102.75 | 102.75 | 102.75 | 102.75 | | |
| | | Wt. rings/cup (g) | 42.84 | 42.84 | 42.84 | 42.84 | 42.84 | 42.84 | | |
| | | Moist unit wt., $\gamma_m$ (pcf) | 98.88 | 98.88 | 98.88 | 98.88 | 98.88 | 98.88 | | |
| | | Wet soil + tare (g) | 328.04 | 328.04 | 328.04 | 328.04 | 328.04 | 328.04 | | |
| | | Dry soil + tare (g) | 312.20 | 312.20 | 312.20 | 312.20 | 312.20 | 312.20 | | |
| | | Tare (g) | 139.72 | 139.72 | 139.72 | 139.72 | 139.72 | 139.72 | | |
| | | Moisture Content, w (%) | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | | |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 90.56 | 90.56 | 90.56 | 90.56 | 90.56 | 90.56 | | |
| | Final Condition | Wet soil + ring/cup (g) | 114.69 | 113.81 | 112.65 | 109.02 | 103.31 | 101.57 | | |
| | | Dry soil + ring/cup (g) | 97.71 | 97.71 | 97.71 | 97.71 | 97.71 | 97.71 | | |
| | | Ring/cup (g) | 42.84 | 42.84 | 42.84 | 42.84 | 42.84 | 42.84 | | |
| | | Dry soil (g) | 54.87 | 54.87 | 54.87 | 54.87 | 54.87 | 54.87 | | |
| | | Moisture Content, w (%) | 30.94 | 29.34 | 27.23 | 20.61 | 10.20 | 7.03 | | |
| | | Volumetric Water Content, θ | 0.449 | 0.426 | 0.395 | 0.299 | 0.148 | 0.102 | | |
| | | **Average Volumetric Moisture:** | **0.446** | **0.424** | **0.396** | **0.318** | **0.157** | **0.107** | **0.061** | **0.031** |

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by:_____
Reviewed:_____



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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**Determination of the Soil Water Characteristic Curve for Desorption**

**Using Pressure Extractor**

**(In general accordance with ASTM D6836)**

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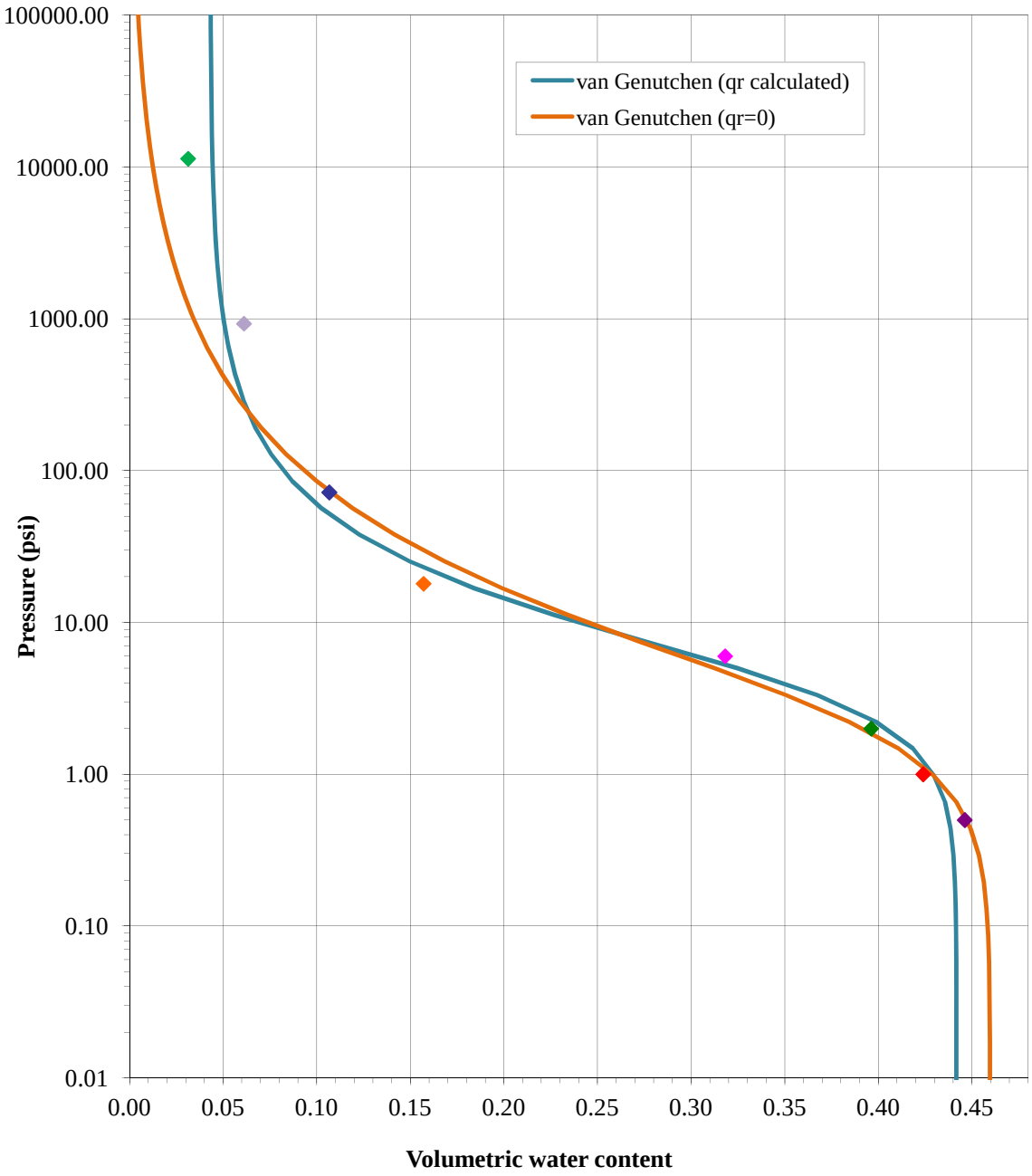
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014

**Boring No.:** WUA-TP004-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt




van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

| $\theta_r$ calculated | | | |
|---|---|---|---|
| $\theta_s$ | 0.4417 | $\theta_s$ | 0.4597 |
| $\theta_r$ | 0.0431 | $\theta_r$ | 0 |
| $\alpha$ | 0.2293 | $\alpha$ | 0.3874 |
| n | 1.7409 | n | 1.4358 |
| m | 0.4256 | m | 0.3035 |
| $R^2$ | 0.9963 | $R^2$ | 0.9872 |

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

**(In general accordance with ASTM D6836)**

© IGES 2014

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014
By: NB/MP

Specific gravity, Gs: 2.650 Assumed

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay
Sample type: Laboratory compacted
Dry unit weight 88.7 pcf
at 8.5 (%) w
Compaction specifications: 85% of ASTM D698B

| | | Test No. | 1 | 2 | 3 | 4 | 5 | 6 | 7* | 8* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tension (psi) | 0.5 | 1.0 | 2.0 | 6.0 | 18.0 | 72.0 | 462.67 | 6381.66 |
| Sample A | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.1883 | 0.1875 |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 1.4715 | 1.4725 |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0002 | 0.0002 |
| | | Wt. rings/cup + wet soil (g) | 101.62 | 101.62 | 101.62 | 101.62 | 101.62 | 101.62 | 32.585 | 32.480 |
| | | Wt. rings/cup (g) | 43.06 | 43.06 | 43.06 | 43.06 | 43.06 | 43.06 | 24.595 | 24.774 |
| | | Moist soil, Ws (g) | 58.56 | 58.56 | 58.56 | 58.56 | 58.56 | 58.56 | 7.990 | 7.706 |
| | | Dry soil (g) | 53.83 | 53.83 | 53.83 | 53.83 | 53.83 | 53.83 | 7.446 | 7.429 |
| | | Moist unit wt., $\gamma_m$ (pcf) | 96.65 | 96.65 | 96.65 | 96.65 | 96.65 | 96.65 | 95.05 | 91.94 |
| | | Wet soil + tare (g) | 304.54 | 304.54 | 304.54 | 304.54 | 304.54 | 304.54 | 32.585 | 32.480 |
| | | Dry soil + tare (g) | 289.91 | 289.91 | 289.91 | 289.91 | 289.91 | 289.91 | 32.041 | 32.203 |
| | | Tare (g) | 123.34 | 123.34 | 123.34 | 123.34 | 123.34 | 123.34 | 24.595 | 24.774 |
| | | Moisture Content, w (%) | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | 7.31 | 3.73 |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 88.85 | 88.85 | 88.85 | 88.85 | 88.85 | 88.85 | 88.58 | 88.64 |
| | Final Condition | Wet soil + ring/cup (g) | 114.15 | 113.24 | 112.02 | 109.13 | 105.67 | 103.28 | 32.578 | 32.478 |
| | | Dry soil + ring/cup (g) | 96.89 | 96.89 | 96.89 | 96.89 | 96.89 | 96.89 | 32.041 | 32.203 |
| | | Ring/cup (g) | 43.06 | 43.06 | 43.06 | 43.06 | 43.06 | 43.06 | 24.595 | 24.774 |
| | | Dry soil (g) | 53.83 | 53.83 | 53.83 | 53.83 | 53.83 | 53.83 | 7.446 | 7.429 |
| | | Moisture Content, w (%) | 32.06 | 30.37 | 28.10 | 22.73 | 16.31 | 11.87 | 7.21 | 3.70 |
| | | Volumetric Water Content, θ | 0.456 | 0.432 | 0.400 | 0.324 | 0.232 | 0.169 | 0.102 | 0.053 |
| Sample B | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | | |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | | |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | | |
| | | Wt. rings/cup + wet soil (g) | 101.04 | 101.04 | 101.04 | 101.04 | 101.04 | 101.04 | | |
| | | Wt. rings/cup (g) | 42.48 | 42.48 | 42.48 | 42.48 | 42.48 | 42.48 | | |
| | | Moist unit wt., $\gamma_m$ (pcf) | 96.65 | 96.65 | 96.65 | 96.65 | 96.65 | 96.65 | | |
| | | Wet soil + tare (g) | 304.54 | 304.54 | 304.54 | 304.54 | 304.54 | 304.54 | | |
| | | Dry soil + tare (g) | 289.91 | 289.91 | 289.91 | 289.91 | 289.91 | 289.91 | | |
| | | Tare (g) | 123.34 | 123.34 | 123.34 | 123.34 | 123.34 | 123.34 | | |
| | | Moisture Content, w (%) | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | | |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 88.85 | 88.85 | 88.85 | 88.85 | 88.85 | 88.85 | | |
| | Final Condition | Wet soil + ring/cup (g) | 113.86 | 112.86 | 111.67 | 108.66 | 104.88 | 102.81 | | |
| | | Dry soil + ring/cup (g) | 96.31 | 96.31 | 96.31 | 96.31 | 96.31 | 96.31 | | |
| | | Ring/cup (g) | 42.48 | 42.48 | 42.48 | 42.48 | 42.48 | 42.48 | | |
| | | Dry soil (g) | 53.83 | 53.83 | 53.83 | 53.83 | 53.83 | 53.83 | | |
| | | Moisture Content, w (%) | 32.60 | 30.74 | 28.53 | 22.94 | 15.92 | 12.07 | | |
| | | Volumetric Water Content, θ | 0.464 | 0.438 | 0.406 | 0.327 | 0.227 | 0.172 | | |
| | | **Average Volumetric Moisture:** | **0.460** | **0.435** | **0.403** | **0.325** | **0.229** | **0.170** | **0.102** | **0.053** |

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by:_____
Reviewed:_____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**Determination of the Soil Water Characteristic Curve for Desorption**

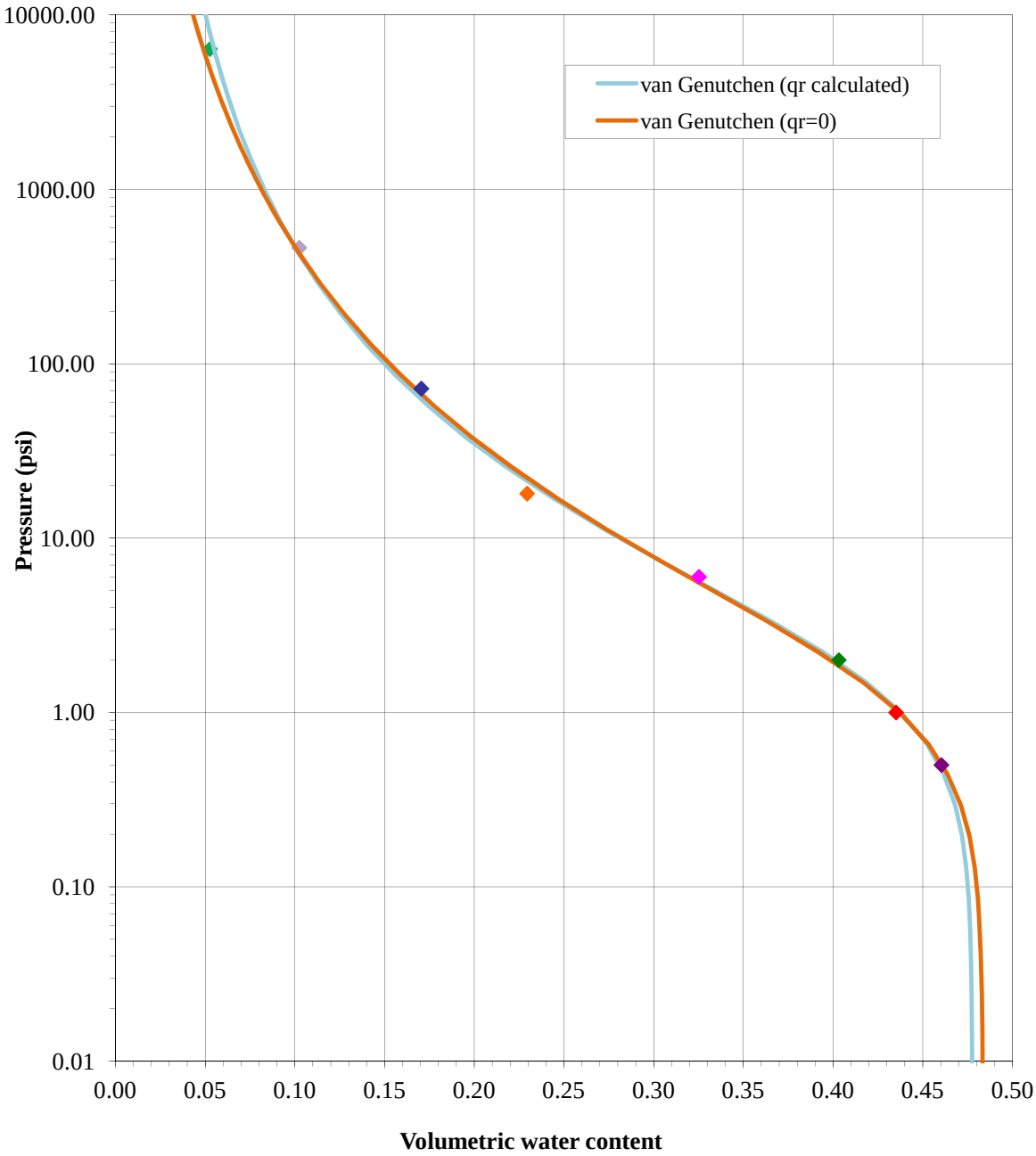
**Using Pressure Extractor**

**(In general accordance with ASTM D6836)**

© IGES 2014

**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014

**Boring No.:** WUA-TP006-01
**Sample:**
**Depth:** 1-10'
Description: Brown silty clay




van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

| $\theta_r$ calculated | | | |
|---|---|---|---|
| $\theta_s$ | 0.4776 | $\theta_s$ | 0.4834 |
| $\theta_r$ | 0.0191 | $\theta_r$ | 0 |
| $\alpha$ | 0.5592 | $\alpha$ | 0.6705 |
| n | 1.3116 | n | 1.2739 |
| m | 0.2376 | m | 0.2150 |
| $R^2$ | 0.9988 | $R^2$ | 0.9985 |

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# Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

**(In general accordance with ASTM D6836)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014
By: NB/MP

Specific gravity, Gs: 2.650 Assumed

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt
Sample type: Laboratory compacted
Dry unit weight 88.6 pcf
at 8.5 (%) w
Compaction specifications: 85% of ASTM D698B

| | | Test No. | 1 | 2 | 3 | 4 | 5 | 6 | 7* | 8* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tension (psi) | 0.5 | 1.0 | 2.0 | 6.0 | 18.0 | 72.0 | 433.66 | 6612.27 |
| Sample A | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.1865 | 0.1863 |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 1.4717 | 1.4710 |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0002 | 0.0002 |
| | | Wt. rings/cup + wet soil (g) | 100.70 | 100.70 | 100.70 | 100.70 | 100.70 | 100.70 | 32.462 | 32.209 |
| | | Wt. rings/cup (g) | 42.58 | 42.58 | 42.58 | 42.58 | 42.58 | 42.58 | 24.556 | 24.586 |
| | | Moist soil, Ws (g) | 58.12 | 58.12 | 58.12 | 58.12 | 58.12 | 58.12 | 7.906 | 7.623 |
| | | Dry soil (g) | 53.71 | 53.71 | 53.71 | 53.71 | 53.71 | 53.71 | 7.368 | 7.343 |
| | | Moist unit wt., $\gamma_m$ (pcf) | 95.92 | 95.92 | 95.92 | 95.92 | 95.92 | 95.92 | 94.94 | 91.72 |
| | | Wet soil + tare (g) | 304.93 | 304.93 | 304.93 | 304.93 | 304.93 | 304.93 | 32.462 | 32.209 |
| | | Dry soil + tare (g) | 291.11 | 291.11 | 291.11 | 291.11 | 291.11 | 291.11 | 31.924 | 31.929 |
| | | Tare (g) | 123.00 | 123.00 | 123.00 | 123.00 | 123.00 | 123.00 | 24.556 | 24.586 |
| | | Moisture Content, w (%) | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | 7.30 | 3.81 |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 88.64 | 88.64 | 88.64 | 88.64 | 88.64 | 88.64 | 88.48 | 88.35 |
| | Final Condition | Wet soil + ring/cup (g) | 113.27 | 111.89 | 110.72 | 106.51 | 103.65 | 102.04 | 32.452 | 32.206 |
| | | Dry soil + ring/cup (g) | 96.29 | 96.29 | 96.29 | 96.29 | 96.29 | 96.29 | 31.924 | 31.929 |
| | | Ring/cup (g) | 42.58 | 42.58 | 42.58 | 42.58 | 42.58 | 42.58 | 24.556 | 24.586 |
| | | Dry soil (g) | 53.71 | 53.71 | 53.71 | 53.71 | 53.71 | 53.71 | 7.368 | 7.343 |
| | | Moisture Content, w (%) | 31.63 | 29.06 | 26.88 | 19.04 | 13.71 | 10.72 | 7.17 | 3.77 |
| | | Volumetric Water Content, θ | 0.449 | 0.413 | 0.382 | 0.270 | 0.195 | 0.152 | 0.102 | 0.053 |
| Sample B | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | | |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | | |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | | |
| | | Wt. rings/cup + wet soil (g) | 101.26 | 101.26 | 101.26 | 101.26 | 101.26 | 101.26 | | |
| | | Wt. rings/cup (g) | 43.11 | 43.11 | 43.11 | 43.11 | 43.11 | 43.11 | | |
| | | Moist unit wt., $\gamma_m$ (pcf) | 95.97 | 95.97 | 95.97 | 95.97 | 95.97 | 95.97 | | |
| | | Wet soil + tare (g) | 304.93 | 304.93 | 304.93 | 304.93 | 304.93 | 304.93 | | |
| | | Dry soil + tare (g) | 291.11 | 291.11 | 291.11 | 291.11 | 291.11 | 291.11 | | |
| | | Tare (g) | 123.00 | 123.00 | 123.00 | 123.00 | 123.00 | 123.00 | | |
| | | Moisture Content, w (%) | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | | |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 88.68 | 88.68 | 88.68 | 88.68 | 88.68 | 88.68 | | |
| | Final Condition | Wet soil + ring/cup (g) | 113.98 | 113.22 | 111.66 | 107.07 | 104.39 | 103.04 | | |
| | | Dry soil + ring/cup (g) | 96.84 | 96.84 | 96.84 | 96.84 | 96.84 | 96.84 | | |
| | | Ring/cup (g) | 43.11 | 43.11 | 43.11 | 43.11 | 43.11 | 43.11 | | |
| | | Dry soil (g) | 53.73 | 53.73 | 53.73 | 53.73 | 53.73 | 53.73 | | |
| | | Moisture Content, w (%) | 31.89 | 30.48 | 27.58 | 19.03 | 14.05 | 11.53 | | |
| | | Volumetric Water Content, θ | 0.453 | 0.433 | 0.392 | 0.271 | 0.200 | 0.164 | | |
| | | **Average Volumetric Moisture:** | **0.451** | **0.423** | **0.387** | **0.270** | **0.197** | **0.158** | **0.102** | **0.053** |

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by:_____
Reviewed:_____

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor**

**(In general accordance with ASTM D6836)**

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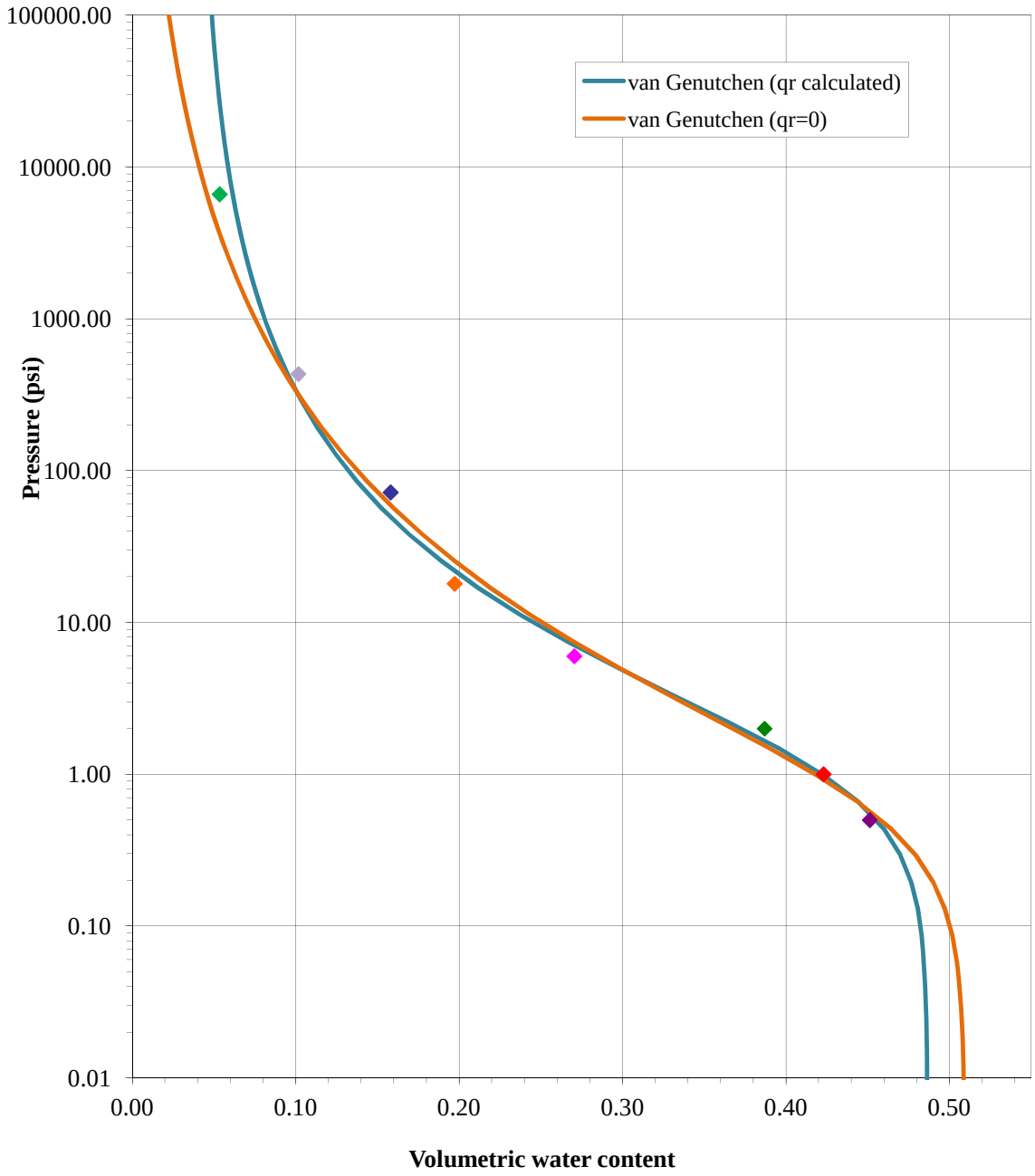
**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014

**Boring No.:** WUA-TP007-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt




van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

| $\theta_r$ calculated | | | |
|---|---|---|---|
| $\theta_s$ | 0.4865 | $\theta_s$ | 0.5091 |
| $\theta_r$ | 0.0409 | $\theta_r$ | 0 |
| $\alpha$ | 0.8571 | $\alpha$ | 1.4349 |
| n | 1.3562 | n | 1.2632 |
| m | 0.2626 | m | 0.2084 |
| $R^2$ | 0.9947 | $R^2$ | 0.9926 |



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2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

# Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

**(In general accordance with ASTM D6836)**

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**Project:** MWH
**No:** 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014
By: NB/MP

Specific gravity, Gs: 2.650 Assumed

**Boring No.:** WUA-TP008-01
**Sample:**
**Depth:** 1-10'
Description: Brown silt
Sample type: Laboratory compacted
Dry unit weight 84.7 pcf
at 8.5 (%) w
Compaction specifications: 85% of ASTM D698B

| | | Test No. | 1 | 2 | 3 | 4 | 5 | 6 | 7* | 8* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tension (psi) | 0.5 | 1.0 | 2.0 | 6.0 | 18.0 | 72.0 | 577.25 | 12281.80 |
| Sample A | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.1900 | 0.1892 |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 1.4713 | 1.4718 |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0002 | 0.0002 |
| | | Wt. rings/cup + wet soil (g) | 100.65 | 100.65 | 100.65 | 100.65 | 100.65 | 100.65 | 32.165 | 31.985 |
| | | Wt. rings/cup (g) | 44.89 | 44.89 | 44.89 | 44.89 | 44.89 | 44.89 | 24.447 | 24.557 |
| | | Moist soil, Ws (g) | 55.76 | 55.76 | 55.76 | 55.76 | 55.76 | 55.76 | 7.718 | 7.428 |
| | | Dry soil (g) | 51.35 | 51.35 | 51.35 | 51.35 | 51.35 | 51.35 | 7.147 | 7.152 |
| | | Moist unit wt., $\gamma_m$ (pcf) | 92.03 | 92.03 | 92.03 | 92.03 | 92.03 | 92.03 | 91.02 | 87.91 |
| | | Wet soil + tare (g) | 379.66 | 379.66 | 379.66 | 379.66 | 379.66 | 379.66 | 32.165 | 31.985 |
| | | Dry soil + tare (g) | 360.76 | 360.76 | 360.76 | 360.76 | 360.76 | 360.76 | 31.594 | 31.709 |
| | | Tare (g) | 140.47 | 140.47 | 140.47 | 140.47 | 140.47 | 140.47 | 24.447 | 24.557 |
| | | Moisture Content, w (%) | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 7.99 | 3.86 |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 84.76 | 84.76 | 84.76 | 84.76 | 84.76 | 84.76 | 84.28 | 84.64 |
| | Final Condition | Wet soil + ring/cup (g) | 114.84 | 114.05 | 112.48 | 107.60 | 103.87 | 102.26 | 32.152 | 31.979 |
| | | Dry soil + ring/cup (g) | 96.24 | 96.24 | 96.24 | 96.24 | 96.24 | 96.24 | 31.594 | 31.709 |
| | | Ring/cup (g) | 44.89 | 44.89 | 44.89 | 44.89 | 44.89 | 44.89 | 24.447 | 24.557 |
| | | Dry soil (g) | 51.35 | 51.35 | 51.35 | 51.35 | 51.35 | 51.35 | 7.147 | 7.152 |
| | | Moisture Content, w (%) | 36.21 | 34.67 | 31.62 | 22.11 | 14.85 | 11.71 | 7.81 | 3.78 |
| | | Volumetric Water Content, θ | 0.492 | 0.471 | 0.429 | 0.300 | 0.202 | 0.159 | 0.105 | 0.051 |
| Sample B | Initial Condition | Sample height, H (in) | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | 0.5035 | | |
| | | Sample diameter, D (in) | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | 2.416 | | |
| | | Sample Volume ($ft^3$) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | | |
| | | Wt. rings/cup + wet soil (g) | 101.75 | 101.75 | 101.75 | 101.75 | 101.75 | 101.75 | | |
| | | Wt. rings/cup (g) | 45.98 | 45.98 | 45.98 | 45.98 | 45.98 | 45.98 | | |
| | | Moist unit wt., $\gamma_m$ (pcf) | 92.04 | 92.04 | 92.04 | 92.04 | 92.04 | 92.04 | | |
| | | Wet soil + tare (g) | 379.66 | 379.66 | 379.66 | 379.66 | 379.66 | 379.66 | | |
| | | Dry soil + tare (g) | 360.76 | 360.76 | 360.76 | 360.76 | 360.76 | 360.76 | | |
| | | Tare (g) | 140.47 | 140.47 | 140.47 | 140.47 | 140.47 | 140.47 | | |
| | | Moisture Content, w (%) | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | | |
| | | Dry Unit Wt., $\gamma_d$ (pcf) | 84.77 | 84.77 | 84.77 | 84.77 | 84.77 | 84.77 | | |
| | Final Condition | Wet soil + ring/cup (g) | 115.88 | 114.65 | 113.25 | 108.03 | 104.97 | 103.23 | | |
| | | Dry soil + ring/cup (g) | 97.34 | 97.34 | 97.34 | 97.34 | 97.34 | 97.34 | | |
| | | Ring/cup (g) | 45.98 | 45.98 | 45.98 | 45.98 | 45.98 | 45.98 | | |
| | | Dry soil (g) | 51.36 | 51.36 | 51.36 | 51.36 | 51.36 | 51.36 | | |
| | | Moisture Content, w (%) | 36.09 | 33.69 | 30.97 | 20.81 | 14.85 | 11.46 | | |
| | | Volumetric Water Content, θ | 0.490 | 0.458 | 0.421 | 0.283 | 0.202 | 0.156 | | |
| | | **Average Volumetric Moisture:** | **0.491** | **0.464** | **0.425** | **0.292** | **0.202** | **0.157** | **0.105** | **0.051** |

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by:_____
Reviewed:_____



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**Determination of the Soil Water Characteristic Curve for Desorption**

**Using Pressure Extractor**

**(In general accordance with ASTM D6836)**

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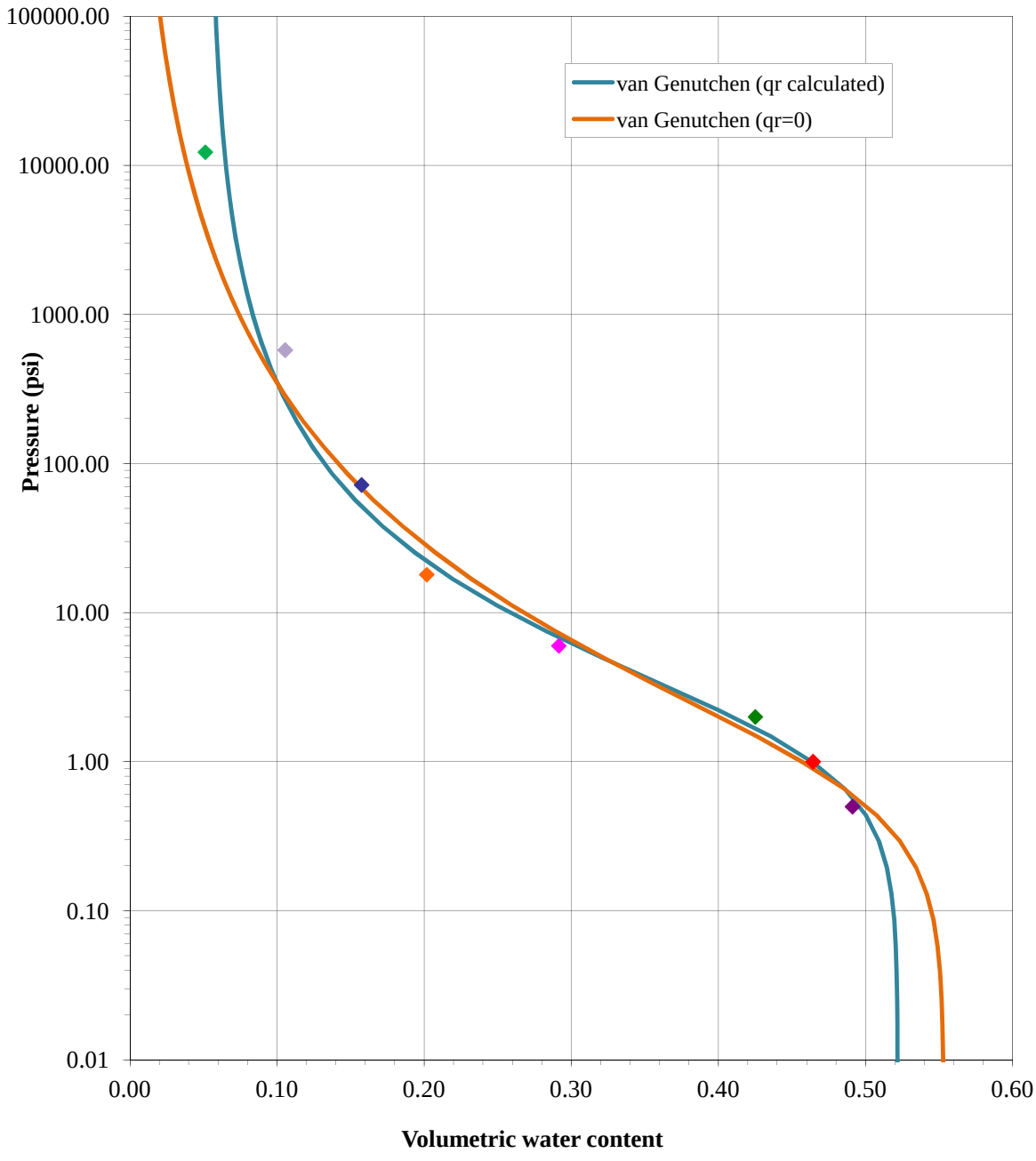
**Project:** **MWH**
**No:** **00303-014**
Location: FMC RDRA Data Gap Investigation
Date: 1/15/2014

**Boring No.:** **WUA-TP008-01**
**Sample:**
**Depth:** **1-10'**
Description: Brown silt




van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

| $\theta_r$ calculated | | | |
|---|---|---|---|
| $\theta_s$ | 0.5219 | $\theta_s$ | 0.5533 |
| $\theta_r$ | 0.0543 | $\theta_r$ | 0 |
| $\alpha$ | 0.6665 | $\alpha$ | 1.2965 |
| n | 1.4267 | n | 1.2802 |
| m | 0.2991 | m | 0.2189 |
| $R^2$ | 0.9946 | $R^2$ | 0.9898 |

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# APPENDIX E

## Agronomic Testing Reports

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Analytical Report

December 11, 2013

Report to:
Chad Tomlinson
MWH Americas Inc.
2890 E. Cottonwood Pkwy.
Suite 300
Salt Lake City, UT 84121

Bill to:
Accounts Payable
MWH Americas Inc.
P.O. Box 6610

Broomfield, CO 80021

Project ID: 10503311.020102 FML
ACZ Project ID: L15653

Chad Tomlinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on November 20, 2013. This project has been assigned to ACZ's project number, L15653. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L15653. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 10, 2014. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed
and approved this report.

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

# Case Narrative

MWH Americas Inc. December 11, 2013

Project ID: 10503311.020102 FML
ACZ Project ID: L15653

## Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 3 soil samples from MWH Americas Inc. on November 20, 2013. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L15653. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Samples were received outside the EPA recommended temperature of 0-6 degrees C.

## Holding Times

All analyses were performed within EPA recommended holding times.

## Sample Analysis

These samples were analyzed for inorganic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The extended qualifier reports may contain footnotes qualifying specific elements due to QC failures. In addition the following has been noted with this specific project:

1. (B1) Target analyte detected in prep blank at or above the method reporting limit. This is due to procedural contamination at the prep level. Client may opt to blank subtract at their discretion.

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**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Inorganic Analytical Results

**MWH Americas Inc.**
Project ID: 10503311.020102 FML
Sample ID: WUA-CP01

ACZ Sample ID: ***L15653-01***
Date Sampled: *11/05/13 10:00*
Date Received: *11/20/13*
Sample Matrix: *Soil*

Metals Analysis

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Cation Exchange Capacity (CEC) | USDA No. 60 (19) | 1 | 8.50 | | * | meq/100g | 0.03 | 0.2 | 12/05/13 11:36 | aeb |
| Phosphorus, total (3050) | M6010B ICP | 101 | 790 | | * | mg/Kg | 10 | 50 | 12/02/13 21:44 | aeb |
| Potassium, total (3050) | M6010B ICP | 101 | 2410 | | | mg/Kg | 30 | 200 | 12/02/13 21:44 | aeb |

Soil Analysis

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | 1 | 0.2 | B | * | % | 0.1 | 0.5 | 12/05/13 14:52 | cra |
| Conductivity @25C | SM2510B | | | | | | | | | |
| Conductivity | | 1 | 0.442 | | * | mmhos/cm | 0.001 | 0.01 | 11/27/13 0:00 | spl |
| Max Particle Size | | 1 | 2000 | | * | um | | | 11/27/13 0:00 | spl |
| Organic Matter | USDA No.60 - Method 24 | 1 | 0.8 | B | * | % | 0.3 | 1 | 11/25/13 22:08 | cra |
| pH, Saturated Paste | EPA 600/2-78-054, section 3.2.2 | | | | | | | | | |
| Max Particle Size | | 1 | 2000 | | * | um | | | 11/27/13 0:00 | spl |
| pH | | 1 | 8.6 | | * | units | 0.1 | 0.1 | 11/27/13 0:00 | spl |
| Solids, Percent | CLPSOW390, PART F, D-98 | 1 | 94.1 | | * | % | 0.1 | 0.5 | 11/22/13 13:54 | spl |

Soil Preparation

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Air Dry at 34 Degrees C | USDA No. 1, 1972 | | | | * | | | | 11/24/13 11:00 | mss2 |
| Cation Exchange Capacity Extraction | USDA No. 60 (19) | | | | * | | | | 12/04/13 18:22 | cdb |
| Digestion - Hot Plate | M3050B ICP | | | | | | | | 11/26/13 13:20 | mss2 |
| Potassium Chloride Extraction | ASA No. 9 33-3.2.2 | | | | * | | | | 12/04/13 15:00 | spl |
| Saturated Paste Extraction | USDA No. 60 (2) | | | | * | | | | 11/26/13 14:20 | spl |
| Sieve-2000 um (2.0mm) | ASA No.9, 15-4.2.2 | | | | * | | | | 11/25/13 11:00 | cra |
| Sieve-250 um (60 mesh) | ASA No.9, 15-4.2.2 | | | | * | | | | 11/25/13 11:00 | cra |

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | 10 | 10.6 | | * | mg/Kg | 0.5 | 5 | 12/10/13 17:16 | bsu |

**Arizona license number: AZ0102**



** Please refer to Qualifier Reports for details.*

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Inorganic Analytical Results

**MWH Americas Inc.**
Project ID: 10503311.020102 FML
Sample ID: WUA-CP02

ACZ Sample ID: ***L15653-02***
Date Sampled: *11/05/13 10:00*
Date Received: *11/20/13*
Sample Matrix: *Soil*

Metals Analysis

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Cation Exchange Capacity (CEC) | USDA No. 60 (19) | 1 | 11.0 | | * | meq/100g | 0.03 | 0.2 | 12/05/13 11:45 | aeb |
| Phosphorus, total (3050) | M6010B ICP | 102 | 780 | | * | mg/Kg | 10 | 50 | 12/02/13 21:53 | aeb |
| Potassium, total (3050) | M6010B ICP | 102 | 2780 | | | mg/Kg | 30 | 200 | 12/02/13 21:53 | aeb |

Soil Analysis

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | 1 | 0.2 | B | * | % | 0.1 | 0.5 | 12/06/13 2:37 | cra |
| Conductivity @25C | SM2510B | | | | | | | | | |
| Conductivity | | 1 | 0.594 | | * | mmhos/cm | 0.001 | 0.01 | 11/27/13 0:00 | spl |
| Max Particle Size | | 1 | 2000 | | * | um | | | 11/27/13 0:00 | spl |
| Organic Matter | USDA No.60 - Method 24 | 1 | 0.9 | B | * | % | 0.3 | 1 | 11/26/13 4:17 | cra |
| pH, Saturated Paste | EPA 600/2-78-054, section 3.2.2 | | | | | | | | | |
| Max Particle Size | | 1 | 2000 | | * | um | | | 11/27/13 0:00 | spl |
| pH | | 1 | 8.4 | | * | units | 0.1 | 0.1 | 11/27/13 0:00 | spl |
| Solids, Percent | CLPSOW390, PART F, D-98 | 1 | 91.9 | | * | % | 0.1 | 0.5 | 11/22/13 14:57 | spl |

Soil Preparation

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Air Dry at 34 Degrees C | USDA No. 1, 1972 | | | | * | | | | 11/24/13 11:30 | mss2 |
| Cation Exchange Capacity Extraction | USDA No. 60 (19) | | | | * | | | | 12/04/13 23:15 | cdb |
| Digestion - Hot Plate | M3050B ICP | | | | | | | | 11/26/13 15:20 | mss2 |
| Potassium Chloride Extraction | ASA No. 9 33-3.2.2 | | | | * | | | | 12/04/13 17:00 | spl |
| Saturated Paste Extraction | USDA No. 60 (2) | | | | * | | | | 11/27/13 4:16 | spl |
| Sieve-2000 um (2.0mm) | ASA No.9, 15-4.2.2 | | | | * | | | | 11/25/13 11:30 | cra |
| Sieve-250 um (60 mesh) | ASA No.9, 15-4.2.2 | | | | * | | | | 11/25/13 11:30 | cra |

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | 10 | 11.1 | | * | mg/Kg | 0.5 | 5 | 12/10/13 17:19 | bsu |

**Arizona license number: AZ0102**



** Please refer to Qualifier Reports for details.*

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**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Inorganic Analytical Results

**MWH Americas Inc.**
Project ID: 10503311.020102 FML
Sample ID: WUA-CP03

ACZ Sample ID: ***L15653-03***
Date Sampled: *11/05/13 10:00*
Date Received: *11/20/13*
Sample Matrix: *Soil*

Metals Analysis

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Cation Exchange Capacity (CEC) | USDA No. 60 (19) | 1 | 10.0 | | * | meq/100g | 0.03 | 0.2 | 12/05/13 11:52 | aeb |
| Phosphorus, total (3050) | M6010B ICP | 101 | 790 | | * | mg/Kg | 10 | 50 | 12/02/13 21:56 | aeb |
| Potassium, total (3050) | M6010B ICP | 101 | 2620 | | | mg/Kg | 30 | 200 | 12/02/13 21:56 | aeb |

Soil Analysis

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | 1 | 0.2 | B | * | % | 0.1 | 0.5 | 12/06/13 8:30 | cra |
| Conductivity @25C | SM2510B | | | | | | | | | |
| Conductivity | | 1 | 0.456 | | * | mmhos/cm | 0.001 | 0.01 | 11/27/13 0:00 | spl |
| Max Particle Size | | 1 | 2000 | | * | um | | | 11/27/13 0:00 | spl |
| Organic Matter | USDA No.60 - Method 24 | 1 | 0.9 | B | * | % | 0.3 | 1 | 11/26/13 7:21 | cra |
| pH, Saturated Paste | EPA 600/2-78-054, section 3.2.2 | | | | | | | | | |
| Max Particle Size | | 1 | 2000 | | * | um | | | 11/27/13 0:00 | spl |
| pH | | 1 | 8.5 | | * | units | 0.1 | 0.1 | 11/27/13 0:00 | spl |
| Solids, Percent | CLPSOW390, PART F, D-98 | 1 | 93.0 | | * | % | 0.1 | 0.5 | 11/22/13 16:00 | spl |

Soil Preparation

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Air Dry at 34 Degrees C | USDA No. 1, 1972 | | | | * | | | | 11/24/13 12:00 | mss2 |
| Cation Exchange Capacity Extraction | USDA No. 60 (19) | | | | * | | | | 12/05/13 4:07 | cdb |
| Digestion - Hot Plate | M3050B ICP | | | | | | | | 11/26/13 16:00 | mss2 |
| Potassium Chloride Extraction | ASA No. 9 33-3.2.2 | | | | * | | | | 12/04/13 18:00 | spl |
| Saturated Paste Extraction | USDA No. 60 (2) | | | | * | | | | 11/27/13 11:15 | spl |
| Sieve-2000 um (2.0mm) | ASA No.9, 15-4.2.2 | | | | * | | | | 11/25/13 12:00 | cra |
| Sieve-250 um (60 mesh) | ASA No.9, 15-4.2.2 | | | | * | | | | 11/25/13 12:00 | cra |

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | 10 | 10.7 | | * | mg/Kg | 0.5 | 5 | 12/10/13 17:21 | bsu |

**Arizona license number: AZ0102**



** Please refer to Qualifier Reports for details.*

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

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# Inorganic Reference

## Report Header Explanations

| | |
|---|---|
| *Batch* | A distinct set of samples analyzed at a specific time |
| *Found* | Value of the QC Type of interest |
| *Limit* | Upper limit for RPD, in %. |
| *Lower* | Lower Recovery Limit, in % (except for LCSS, mg/Kg) |
| *MDL* | Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations. |
| *PCN/SCN* | A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis |
| *PQL* | Practical Quantitation Limit, typically 5 times the MDL. |
| *QC* | True Value of the Control Sample or the amount added to the Spike |
| *Rec* | Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg) |
| *RPD* | Relative Percent Difference, calculation used for Duplicate QC Types |
| *Upper* | Upper Recovery Limit, in % (except for LCSS, mg/Kg) |
| *Sample* | Value of the Sample of interest |

## QC Sample Types

| | | | |
|---|---|---|---|
| *AS* | Analytical Spike (Post Digestion) | *LCSWD* | Laboratory Control Sample - Water Duplicate |
| *ASD* | Analytical Spike (Post Digestion) Duplicate | *LFB* | Laboratory Fortified Blank |
| *CCB* | Continuing Calibration Blank | *LFM* | Laboratory Fortified Matrix |
| *CCV* | Continuing Calibration Verification standard | *LFMD* | Laboratory Fortified Matrix Duplicate |
| *DUP* | Sample Duplicate | *LRB* | Laboratory Reagent Blank |
| *ICB* | Initial Calibration Blank | *MS* | Matrix Spike |
| *ICV* | Initial Calibration Verification standard | *MSD* | Matrix Spike Duplicate |
| *ICSAB* | Inter-element Correction Standard - A plus B solutions | *PBS* | Prep Blank - Soil |
| *LCSS* | Laboratory Control Sample - Soil | *PBW* | Prep Blank - Water |
| *LCSSD* | Laboratory Control Sample - Soil Duplicate | *PQV* | Practical Quantitation Verification standard |
| *LCSW* | Laboratory Control Sample - Water | *SDL* | Serial Dilution |

## QC Sample Type Explanations

| | |
|---|---|
| Blanks | Verifies that there is no or minimal contamination in the prep method or calibration procedure. |
| Control Samples | Verifies the accuracy of the method, including the prep procedure. |
| Duplicates | Verifies the precision of the instrument and/or method. |
| Spikes/Fortified Matrix | Determines sample matrix interferences, if any. |
| Standard | Verifies the validity of the calibration. |

## ACZ Qualifiers (Qual)

| | |
|---|---|
| B | Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity. |
| H | Analysis exceeded method hold time. pH is a field test with an immediate hold time. |
| L | Target analyte response was below the laboratory defined negative threshold. |
| U | The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit. |

## Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

## Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

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# Inorganic QC Summary

**MWH Americas Inc.**

ACZ Project ID: ***L15653***

**Carbon, total organic (TOC)** ASA No.9 29-2.2.4 Combustion/IR

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355912** | | | | | | | | | | | | | |
| WG355912PBS | PBS | 12/05/13 9:00 | | | | U | % | | -0.3 | 0.3 | | | |
| L15653-01DUP | DUP | 12/05/13 20:45 | | | .2 | .2 | % | | | | 0 | 20 | RA ZQ |

**Cation Exchange Capacity (CEC)** USDA No. 60 (19)

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355925** | | | | | | | | | | | | | |
| WG355925ICV | ICV | 12/05/13 11:17 | II131113-1 | 100 | | 97.97 | mg/L | 98 | 90 | 110 | | | |
| WG355925ICB | ICB | 12/05/13 11:20 | | | | U | meq/100g | | -0.9 | 0.9 | | | |
| WG355857PBS | PBS | 12/05/13 11:33 | | | | U | meq/100g | | -0.09 | 0.09 | | | |
| L15653-01AS | AS | 12/05/13 11:39 | IICECSPIKE | 10.8763 | 8.5 | 17.0846 | meq/100g | 78.9 | 75 | 125 | | | |
| L15653-01ASD | ASD | 12/05/13 11:42 | IICECSPIKE | 10.8763 | 8.5 | 17.4218 | meq/100g | 82 | 75 | 125 | 1.95 | 20 | |
| L15653-03DUP | DUP | 12/05/13 11:55 | | | 10 | 10.1496 | meq/100g | | | | 1.5 | 20 | |

**Conductivity @25C** SM2510B

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355542** | | | | | | | | | | | | | |
| L15653-01DUP | DUP | 11/27/13 3:24 | | | .442 | .443 | nmhos/cm | | | | 0.2 | 20 | |

**Nitrogen, ammonia (KCL)** M350.1 - Automated Phenate

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG356166** | | | | | | | | | | | | | |
| WG356166ICV | ICV | 12/10/13 12:10 | WI131021-1 | 1.003 | | 1.041 | mg/L | 103.8 | 90 | 110 | | | |
| WG356166ICB | ICB | 12/10/13 12:13 | | | | U | mg/L | | -0.15 | 0.15 | | | |
| **WG356206** | | | | | | | | | | | | | |
| WG356206LFB | LFB | 12/10/13 17:14 | WI121218-3 | 1 | | 1.093 | mg/L | 109.3 | 90 | 110 | | | |
| WG355866PBS | PBS | 12/10/13 17:15 | | | | 6.27 | mg/Kg | | -1.5 | 1.5 | | | B1 |
| L15653-01DUP | DUP | 12/10/13 17:17 | | | 10.6 | 9.9 | mg/Kg | | | | 6.8 | 20 | |
| L15653-02AS | AS | 12/10/13 17:20 | WI121218-3 | 10 | 11.1 | 21.68 | mg/Kg | 105.8 | 75 | 125 | | | |

**Organic Matter** USDA No.60 - Method 24

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355454** | | | | | | | | | | | | | |
| WG355454LCSS | LCSS | 11/25/13 16:00 | PCN32557 | 2 | | 1.95 | % | 97.5 | | | | | |
| WG355454PBS | PBS | 11/25/13 19:04 | | | | U | % | | -0.3 | 0.3 | | | |
| L15653-01DUP | DUP | 11/26/13 1:12 | | | .8 | .72 | % | | | | 10.5 | 20 | RA |

**pH, Saturated Paste** EPA 600/2-78-054, section 3.2.2

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355542** | | | | | | | | | | | | | |
| WG355542ICV | ICV | 11/26/13 22:10 | PCN42578 | 4 | | 4 | units | 100 | 3.9 | 4.1 | | | |
| L15653-01DUP | DUP | 11/27/13 3:24 | | | 8.6 | 8.66 | units | | | | 0.7 | 20 | |

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# Inorganic QC Summary

**MWH Americas Inc.**

ACZ Project ID: ***L15653***

**Phosphorus, total (3050)** M6010B ICP

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355673** | | | | | | | | | | | | | |
| WG355673ICV | ICV | 12/02/13 21:13 | II131111-1 | 5 | | 5.19 | mg/L | 103.8 | 90 | 110 | | | |
| WG355673ICB | ICB | 12/02/13 21:16 | | | | U | mg/L | | -0.3 | 0.3 | | | |
| WG355503PBS | PBS | 12/02/13 21:28 | | | | U | mg/Kg | | -30 | 30 | | | |
| WG355503LCSS2 | LCSS | 12/02/13 21:38 | PCN39902 | 842 | | 704 | mg/Kg | | 673.6 | 1010.4 | | | |
| WG355503LCSSD2 | LCSSD | 12/02/13 21:41 | PCN39902 | 842 | | 704 | mg/Kg | | 673.6 | 1010.4 | 0 | 20 | |
| L15653-01MS | MS | 12/02/13 21:47 | II131119-3 | 101.0202 | 790 | 892 | mg/Kg | 101 | 75 | 125 | | | |
| L15653-01MSD | MSD | 12/02/13 21:50 | II131119-3 | 101.0202 | 790 | 879 | mg/Kg | 88.1 | 75 | 125 | 1.47 | 20 | |

**Potassium, total (3050)** M6010B ICP

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355673** | | | | | | | | | | | | | |
| WG355673ICV | ICV | 12/02/13 21:13 | II131111-1 | 20 | | 19.64 | mg/L | 98.2 | 90 | 110 | | | |
| WG355673ICB | ICB | 12/02/13 21:16 | | | | U | mg/L | | -0.9 | 0.9 | | | |
| WG355503PBS | PBS | 12/02/13 21:28 | | | | U | mg/Kg | | -90 | 90 | | | |
| WG355503LCSS1 | LCSS | 12/02/13 21:32 | PCN42472 | 2600 | | 2612 | mg/Kg | | 1720 | 3470 | | | |
| WG355503LCSSD1 | LCSSD | 12/02/13 21:35 | PCN42472 | 2600 | | 2872 | mg/Kg | | 1720 | 3470 | 9.5 | 20 | |
| L15653-01MS | MS | 12/02/13 21:47 | II131119-3 | 10094.48439 | 2410 | 13009 | mg/Kg | 105 | 75 | 125 | | | |
| L15653-01MSD | MSD | 12/02/13 21:50 | II131119-3 | 10094.48439 | 2410 | 13059 | mg/Kg | 105.5 | 75 | 125 | 0.38 | 20 | |

**Solids, Percent** CLPSOW390, PART F, D-98

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG355296** | | | | | | | | | | | | | |
| WG355296PBS | PBS | 11/21/13 19:00 | | | | U | % | | 99.9 | 100.1 | | | |
| L15561-01DUP | DUP | 11/21/13 22:09 | | | 23.9 | 24.39 | % | | | | 2 | 20 | |

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

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# Inorganic Extended Qualifier Report

**MWH Americas Inc.**

ACZ Project ID: ***L15653***

| ACZ ID | WORKNUM | PARAMETER | METHOD | QUAL | DESCRIPTION |
|---|---|---|---|---|---|
| **L15653-01** | WG355925 | Cation Exchange Capacity (CEC) | USDA No. 60 (19) | ZH | Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected. |
| | WG355912 | Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | Q6 | Sample was received above recommended temperature. |
| | | | ASA No.9 29-2.2.4 Combustion/IR | RA | Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL). |
| | | | ASA No.9 29-2.2.4 Combustion/IR | ZQ | Analyte was not evaluated in the laboratory control standard. Either the analyte is not included in the scope of the analytical method or a commercial standard containing the analyte is not available. |
| | WG355454 | Organic Matter | USDA No.60 - Method 24 | RA | Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL). |
| | WG356206 | Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | B1 | Target analyte detected in prep / method blank at or above the method reporting limit. See Case Narrative. |
| **L15653-02** | WG355925 | Cation Exchange Capacity (CEC) | USDA No. 60 (19) | ZH | Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected. |
| | WG355912 | Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | Q6 | Sample was received above recommended temperature. |
| | | | ASA No.9 29-2.2.4 Combustion/IR | RA | Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL). |
| | | | ASA No.9 29-2.2.4 Combustion/IR | ZQ | Analyte was not evaluated in the laboratory control standard. Either the analyte is not included in the scope of the analytical method or a commercial standard containing the analyte is not available. |
| | WG355454 | Organic Matter | USDA No.60 - Method 24 | RA | Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL). |
| | WG356206 | Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | B1 | Target analyte detected in prep / method blank at or above the method reporting limit. See Case Narrative. |
| **L15653-03** | WG355925 | Cation Exchange Capacity (CEC) | USDA No. 60 (19) | ZH | Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected. |
| | WG355912 | Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | Q6 | Sample was received above recommended temperature. |
| | | | ASA No.9 29-2.2.4 Combustion/IR | RA | Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL). |
| | | | ASA No.9 29-2.2.4 Combustion/IR | ZQ | Analyte was not evaluated in the laboratory control standard. Either the analyte is not included in the scope of the analytical method or a commercial standard containing the analyte is not available. |
| | WG355454 | Organic Matter | USDA No.60 - Method 24 | RA | Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL). |
| | WG356206 | Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | B1 | Target analyte detected in prep / method blank at or above the method reporting limit. See Case Narrative. |

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ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

# Certification Qualifiers

**MWH Americas Inc.** ACZ Project ID: ***L15653***

## Metals Analysis

**The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.**

| | |
|---|---|
| Cation Exchange Capacity (CEC) | USDA No. 60 (19) |
| Phosphorus, total (3050) | M6010B ICP |

**The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.**

| | |
|---|---|
| Cation Exchange Capacity (CEC) | USDA No. 60 (19) |

## Soil Analysis

**The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.**

| | |
|---|---|
| Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR |
| Conductivity @25C | SM2510B |
| Organic Matter | USDA No.60 - Method 24 |
| pH, Saturated Paste | EPA 600/2-78-054, section 3.2.2 |
| Solids, Percent | CLPSOW390, PART F, D-98 |

**The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.**

| | |
|---|---|
| Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR |
| Conductivity @25C | SM2510B |
| Organic Matter | USDA No.60 - Method 24 |
| pH, Saturated Paste | EPA 600/2-78-054, section 3.2.2 |
| Solids, Percent | CLPSOW390, PART F, D-98 |

## Wet Chemistry

**The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.**

| | |
|---|---|
| Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate |

**The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.**

| | |
|---|---|
| Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate |

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**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Sample Receipt

**MWH Americas Inc.**
10503311.020102 FML

| | |
|---|---|
| ACZ Project ID: | L15653 |
| Date Received: | 11/20/2013 10:28 |
| Received By: | mtb |
| Date Printed: | 11/21/2013 |

## Receipt Verification

| | YES | NO | NA |
|---|---|---|---|
| 1) Is a foreign soil permit included for applicable samples? | | | X |
| 2) Is the Chain of Custody or other directive shipping papers present? | X | | |
| 3) Does this project require special handling procedures such as CLP protocol? | | | X |
| 4) Are any samples NRC licensable material? | | | X |
| 5) If samples are received past hold time, proceed with requested short hold time analyses? | X | | |
| 6) Is the Chain of Custody complete and accurate? | X | | |
| 7) Were any changes made to the Chain of Custody prior to ACZ receiving the samples? | | X | |

## Samples/Containers

| | YES | NO | NA |
|---|---|---|---|
| 8) Are all containers intact and with no leaks? | X | | |
| 9) Are all labels on containers and are they intact and legible? | X | | |
| 10) Do the sample labels and Chain of Custody match for Sample ID, Date, and Time? | X | | |
| 11) For preserved bottle types, was the pH checked and within limits? | | | X |
| 12) Is there sufficient sample volume to perform all requested work? | X | | |
| 13) Is the custody seal intact on all containers? | | | X |
| 14) Are samples that require zero headspace acceptable? | | | X |
| 15) Are all sample containers appropriate for analytical requirements? | X | | |
| 16) Is there an Hg-1631 trip blank present? | | | X |
| 17) Is there a VOA trip blank present? | | | X |
| 18) Were all samples received within hold time? | X | | |

## Chain of Custody Related Remarks

## Client Contact Remarks

## Shipping Containers

| Cooler Id | Temp (°C) | Rad (µR/Hr) | Custody Seal Intact? |
|---|---|---|---|
| NA18751 | 14.8 | 13 | N/A |

Was ice present in the shipment container(s)?

No - Wet or gel ice was not present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

L15653 Chain of Custody

L15653

# CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

Chain of Custody ID _____
Cooler ID _____
Page _____ of _____
Air Bill No. _____

LABORATORY ACZ
Contact Michael McDonough
MWH
Phone (801) 617-4200 FAX (801) 617-3200
MWH Contact Chad Tomlinson
Project 105033H.020102 FMC
Project Number ↓
Date Due 11/25/2013
Samplers Signature

| Location ID | Field Sample ID | Depth Interval (ft) | Date Collected | Time Collected | Sample Number | Matrix[a] | Sampling Technique[b] | USDA No. 60(b) CEC | Phosphorus MG0103 ICP | Potassium MG0103 ICP | Sodium MG0103 ICP | ASA 9 | TOC ASA 9 | Conductivity SM 2510B | Organic Matter USDA No. 60 | pH | EPA 6010 | Nitrogen M350.1 | | | AB LOT (DDMMYYNN) | EB LOT (DDMMYYNN) | TB LOT (DDMMYYNN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WUA-CP01 | 1'-15' | 11/5/2013 | 10:00 | | SO | G | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| | WUA-CP02 | 1'-15' | " | " | | SO | G | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| | WUA-CP03 | 1'-15' | " | " | | SO | G | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ~~NA~~ | | | | |

[a] **Matrix:**
SO – Soil
SE – Sediment
WS – Surface Water
WG – Ground Water
LF – Product
AA – Air
SW – Wipe
EP/TCLP Leachate
WQ – Trip Blank,
EB – Equipment Blanks
WW – Wastewater

[b] **Sampling Technique:**
Composite=C
Grab=G
Hand Auger=HA
Paristalic Pump=PP
Cone Penetrometer=CN
Bladder Pump=BP
Submersible Pump=SP
Bailer=B
GeoProbe=PR

**SPECIAL INSTRUCTIONS:**

| Relinquished by/Affiliation | Received by/Affiliation | Date | Time |
|---|---|---|---|
| | LBG ACZ | 11.20.13 | 10:20 |
| | | | |
| | | | |
| | | | |
| | | | |

| Relinquished by/Affiliation | Received by/Affiliation | Date | Time |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**LABORATORY USE ONLY**

**SAMPLES WERE:**

1 Shipped or hand delivered
*Notes:*

2 Ambient or Chilled
*Notes:*

3 Temperature _____

4 Received Broken/Leaking (Improperly Sealed)
Y N
*Notes:*

5 Properly Preserved
Y N
*Notes:*

6 Received Within Holding Times
Y N
*Notes:*

**COC Tape Was:**

1 Present on Outer Package
Y N NA

2 Unbroken on Outer Package
Y N NA

3 Present on Sample
Y N NA

4 Unbroken on Sample
Y N NA
*Notes:*

Discrepancies Between Sample Labels and COC Record?
Y N
*Notes:*

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**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Analytical Quote

Chad Tomlinson
MWH Americas Inc.
2890 E. Cottonwood Pkwy. Suite 300
Salt Lake City, UT 84121


11/7/2013

## Quote Number: FMC-AGRONOMIC

**Matrix:** Soil — 3 Samples, One Time Analysis of Soil - FMC Agronomic Testing

| Parameter | Method | Detection Limit | Cost/Sample |
|---|---|---|---|
| **Metals Analysis** | | | |
| Cation Exchange Capacity (CEC) | USDA No. 60 (19) | 0.03 meq/100g | $24.00 |
| Phosphorus, total (3050) | M6010B ICP | 10 mg/Kg | $10.00 |
| Potassium, total (3050) | M6010B ICP | 30 mg/Kg | $10.00 |
| **Misc.** | | | |
| Electronic Data Deliverable | | | $0.00 |
| Quality Control Summary | | | $0.00 |
| Setup charge for ICP, total | | | $16.00 |
| **Sample Preparation** | | | |
| Air Dry at 34 Degrees C | USDA No. 1, 1972 | | $8.00 |
| Cation Exchange Capacity Extraction | USDA No. 60 (19) | | $0.00 |
| Digestion - Hot Plate | M3050B ICP | | $16.00 |
| Potassium Chloride Extraction | ASA No. 9 33-3.2.2 | | $12.00 |
| Saturated Paste Extraction | USDA No. 60 (2) | | $18.00 |
| Sieve-2000 um (2.0mm) | ASA No.9, 15-4.2.2 | | $12.00 |
| Sieve-250 um (60 mesh) | ASA No.9, 15-4.2.2 | | $12.00 |
| **Soil Analysis** | | | |
| Carbon, total organic (TOC) | ASA No.9 29-2.2.4 Combustion/IR | 0.1 % | $38.00 |
| Conductivity @25C | SM2510B | 0.001 mmhos/cm | $8.00 |
| Organic Matter | USDA No.60 - Method 24 | 0.3 % | $25.00 |
| pH, Saturated Paste | EPA 600/2-78-054, section 3.2.2 | 0.1 units | $8.00 |
| Solids, Percent | CLPSOW390, PART F, D-98 | 0.1 % | $8.00 |
| **Wet Chemistry** | | | |
| Nitrogen, ammonia (KCL) | M350.1 - Automated Phenate | 0.5 mg/Kg | $11.00 |
| | | **Cost/Sample:** | **$236.00** |

This quote is based on a Standard Turnaround Time (TAT) of approximately 21 days for soil and solid matrices (15 working days). TAT may vary with seasonal heavy workload. Please contact your PM if rush TAT is required. Rush TAT needs to be pre-approved prior to sample shipment to assure that due dates can be met. Pricing includes standard reporting formats and standard ACZ EDDs. All projects received are subject to a $125.00 Minimum Charge. Please note that method detection limits are estimates and may be elevated depending on sample matrices that require dilution. Pricing includes coolers, soil jars or bags, labels, COCs and ice-packs if needed for your analysis, shipped to your site or office via UPS ground. Return shipping is the responsibility of the client. Please allow ample time for your bottles to arrive. Please note that soil preparation charges may fluctuate depending on the condition and volume of samples upon receipt. Wet samples may increase your TAT if air-drying is needed per your analysis.

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ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

# Analytical Quote

Chad Tomlinson
MWH Americas Inc.
2890 E. Cottonwood Pkwy. Suite 300
Salt Lake City, UT 84121


11/7/2013

## Quote Number: FMC-AGRONOMIC

CONTRACT DETAILS

Pricing includes shipment of all standard sample containers and related paperwork by UPS Ground Service. Please allow three to five days for delivery when ordering containers. ACZ must be notified prior to receiving samples of all special requests such as electronic data deliverables or special reporting reqirements. The client will be charged for special sample containers or express shipping and additional charges may apply for non-standard requests.

This quotation is valid for six months from the bid date unless specified otherwise in the bid. All bids must be signed and returned to ACZ before the project(s) is received. The authorized signature represents acceptance of the pricing as well as the general terms and conditions of ACZ Laboratories, Inc. which may be downloaded from our web site at http://www.acz.com/PDF/termsconditions.pdf. Please note that MDL's in this quote may possibly increase due to sample matrix or samples with high TDS.

All orders that require shipping of coolers are subject to a minimum charge of $200.00. Local orders without shipping are subject to a minimum charge of $125.00. Samples may incur a $11.00/sample disposal fee for any samples deemed to be hazardous.

ACZ Representative (Authorized signature and date) _____

Client Representative (Authorized signature and date) _____

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# APPENDIX F

## Root Density Testing Report

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

Table of Soil and Root Weights for FMC Vegetation Survey Sample Locations from Nov. 12 and 13, 2013.

| Sample | Soil Dry Weight with Roots (grams) | Root Dry Weight (grams) | Soil Dry Weight Without Roots (grams) | Grams of Roots per 100 grams of Soil |
|---|---|---|---|---|
| **Grid #6—Location #1** | | | | |
| 0-6 inches | 807.45 | 0.15 | 807.30 | 0.019 |
| 6-12 inches | 798.26 | 0.62 | 797.64 | 0.078 |
| 12-18 inches | 786.17 | 0.02 | 786.15 | 0.003 |
| **Grid #6—Location #2** | | | | |
| 0-6 inches | 785.39 | 0.66 | 784.73 | 0.084 |
| 6-12 inches | 792.90 | 0.15 | 792.75 | 0.019 |
| 12-18 inches | 837.52 | 0.12 | 837.40 | 0.014 |
| **Grid #6—Location #3** | | | | |
| 0-6 inches | 744.77 | 0.24 | 744.53 | 0.032 |
| 6-12 inches | 823.04 | 0.11 | 822.93 | 0.013 |
| 12-18 inches | 804.68 | 0.04 | 804.64 | 0.005 |
| **Grid #7—Location #1** | | | | |
| 0-6 inches | 684.09 | 0.27 | 683.82 | 0.039 |
| 6-12 inches | 813.18 | 0.16 | 813.02 | 0.020 |
| 12-18 inches | 832.20 | 0.11 | 832.09 | 0.013 |
| **Grid #7—Location #2** | | | | |
| 0-6 inches | 829.41 | 0.30 | 829.11 | 0.036 |
| 6-12 inches | 746.12 | 0.22 | 745.90 | 0.029 |
| 12-18 inches | 844.83 | 0.18 | 844.65 | 0.021 |
| **Grid #7—Location #3** | | | | |
| 0-6 inches | 764.65 | 0.68 | 763.97 | 0.089 |
| 6-12 inches | 781.57 | 0.19 | 781.38 | 0.024 |
| 12-18 inches | 872.89 | 0.13 | 872.76 | 0.015 |
| **Grid #8—Location #1** | | | | |
| 0-6 inches | 769.74 | 0.79 | 768.95 | 0.102 |
| 6-12 inches | No sample | No sample | No sample | No sample |
| 12-18 inches | 806.99 | 0.16 | 806.83 | 0.020 |
| 18-24 inches | 849.00 | 0.05 | 848.95 | 0.006 |
| **Grid #8—Location #2** | | | | |
| 0-6 inches | 762.51 | 0.58 | 761.93 | 0.076 |
| 6-12 inches | 872.86 | 0.65 | 872.21 | 0.075 |
| 12-18 inches | 801.06 | 0.10 | 800.96 | 0.013 |
| 18-24 inches | 742.14 | 0.03 | 742.11 | 0.004 |
| **Grid #8—Location #3** | | | | |
| 0-6 inches | 797.74 | 0.38 | 797.36 | 0.048 |
| 6-12 inches | 820.28 | 0.23 | 820.05 | 0.028 |
| 12-18 inches | 839.66 | 0.11 | 839.55 | 0.013 |
| **Grid #13—Location #1** | | | | |
| 0-6 inches | 839.18 | 0.87 | 838.31 | 0.104 |
| 6-12 inches | 699.50 | 0.25 | 699.25 | 0.036 |
| 12-18 inches | No sample | No sample | No sample | No sample |

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| Sample | Soil Dry Weight with Roots (grams) | Root Dry Weight (grams) | Soil Dry Weight Without Roots (grams) | Grams of Roots per 100 grams of Soil |
|---|---|---|---|---|
| **Grid #13—Location #2** | | | | |
| 0-6 inches | 793.79 | 0.51 | 793.28 | 0.064 |
| 6-12 inches | 849.62 | 0.27 | 849.35 | 0.032 |
| 12-18 inches | No sample | No sample | No sample | No sample |
| **Grid #13—Location #3** | | | | |
| 0-6 inches | 725.44 | 0.73 | 724.71 | 0.101 |
| 6-12 inches | 961.91 | 0.33 | 961.58 | 0.034 |
| 12-18 inches | 867.40 | 0.12 | 867.28 | 0.014 |
| **Grid #14—Location #1** | | | | |
| 0-6 inches | 814.19 | 0.71 | 813.48 | 0.087 |
| 6-12 inches | 833.37 | 0.45 | 832.92 | 0.054 |
| 12-18 inches | 834.95 | 0.13 | 834.82 | 0.016 |
| **Grid #14—Location #2** | | | | |
| 0-6 inches | 713.84 | 0.78 | 713.06 | 0.109 |
| 6-12 inches | 898.16 | 0.46 | 897.70 | 0.051 |
| 12-18 inches | 797.55 | 0.21 | 797.34 | 0.026 |
| **Grid #14—Location #3** | | | | |
| 0-6 inches | 807.28 | 0.43 | 806.85 | 0.053 |
| 6-12 inches | 780.36 | 0.31 | 780.05 | 0.040 |
| 12-18 inches | 805.32 | 0.15 | 805.17 | 0.019 |
| **Grid #15—Location #1** | | | | |
| 0-6 inches | 835.20 | 0.45 | 834.75 | 0.054 |
| 6-12 inches | 772.33 | 0.14 | 772.19 | 0.018 |
| 12-18 inches | 800.00 | 0.09 | 799.91 | 0.011 |
| **Grid #15—Location #2** | | | | |
| 0-6 inches | 729.58 | 0.56 | 729.02 | 0.077 |
| 6-12 inches | 746.83 | 0.28 | 746.55 | 0.038 |
| 12-18 inches | 848.75 | 0.07 | 848.68 | 0.008 |
| **Grid #15—Location #3** | | | | |
| 0-6 inches | 759.06 | 0.45 | 758.61 | 0.060 |
| 6-12 inches | 930.29 | 0.21 | 930.08 | 0.023 |
| 12-18 inches | 777.64 | 0.10 | 777.54 | 0.013 |
| **Grid #16—Location #1** | | | | |
| 0-6 inches | 822.27 | 0.57 | 821.70 | 0.069 |
| 6-12 inches | 772.75 | 0.39 | 772.36 | 0.051 |
| 12-18 inches | 831.66 | 0.13 | 831.53 | 0.016 |
| **Grid #16—Location #2** | | | | |
| 0-6 inches | 707.11 | 0.83 | 706.28 | 0.118 |
| 6-12 inches | 844.97 | 0.37 | 844.60 | 0.044 |
| 12-18 inches | 791.54 | 0.18 | 791.36 | 0.023 |

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

| Sample | Soil Dry Weight with Roots (grams) | Root Dry Weight (grams) | Soil Dry Weight Without Roots (grams) | Grams of Roots per 100 grams of Soil |
|---|---|---|---|---|
| **Grid #16—Location #3** | | | | |
| 0-6 inches | 743.60 | 0.62 | 742.98 | 0.083 |
| 6-12 inches | 822.37 | 0.25 | 822.12 | 0.030 |
| 12-18 inches | 773.69 | 0.12 | 773.57 | 0.016 |
| **Grid #17—Location #1** | | | | |
| 0-6 inches | 708.05 | 0.66 | 707.39 | 0.093 |
| 6-12 inches | 778.98 | 0.19 | 778.79 | 0.024 |
| 12-18 inches | 901.58 | 0.12 | 901.46 | 0.013 |
| 18-24 inches | 810.23 | 0.04 | 810.19 | 0.005 |
| **Grid #17—Location #2** | | | | |
| 0-6 inches | 833.19 | 0.43 | 832.76 | 0.052 |
| 6-12 inches | 811.03 | 0.16 | 810.87 | 0.020 |
| 12-18 inches | 893.77 | 0.13 | 893.64 | 0.015 |
| 18-24 inches | 877.61 | 0.02 | 877.59 | 0.002 |
| **Grid #17—Location #3** | | | | |
| 0-6 inches | 806.03 | 0.30 | 805.73 | 0.037 |
| 6-12 inches | 871.40 | 0.27 | 871.13 | 0.031 |
| 12-18 inches | 795.86 | 0.12 | 795.74 | 0.015 |
| 18-24 inches | 796.35 | 0.05 | 796.30 | 0.006 |
| **Grid #18—Location #1** | | | | |
| 0-6 inches | 838.61 | 0.12 | 838.49 | 0.014 |
| 6-12 inches | 854.60 | 0.15 | 854.45 | 0.018 |
| 12-18 inches | 798.19 | 0.02 | 798.17 | 0.003 |
| **Grid #18—Location #2** | | | | |
| 0-6 inches | 776.15 | 0.53 | 775.62 | 0.068 |
| 6-12 inches | 785.08 | 0.18 | 784.90 | 0.023 |
| 12-18 inches | 838.00 | 0.11 | 837.89 | 0.013 |
| **Grid #18—Location #3** | | | | |
| 0-6 inches | 761.44 | 0.31 | 761.13 | 0.041 |
| 6-12 inches | 731.57 | 0.16 | 731.41 | 0.022 |
| 12-18 inches | 784.39 | 0.09 | 784.30 | 0.011 |

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# APPENDIX G

## Stormwater Sewer Decontamination Water Laboratory Analysis Report and Video Survey

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf


# IAS EnviroChem

3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com


**Kase Warbonnet Inc.**
**Mark R. Smith**
**1477 Thunderbolt**
**Pocatello, ID 83204**

**Date Submitted:** 11/14/2013
**Date Reported:** 12/03/2013

## Certificate of Analysis

**Sample Description:** 111413-SDL
**Lab Tracking #:** I311052-01
**Sampling Date/Time:** 11/14/13 13:40

| Analyte | Result | Units | Method | Analyzed | Analyst |
|---|---|---|---|---|---|
| pH | 7.6 | pH Units | 150.1 | 11/18/2013 | MAD |
| TCLP Arsenic | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Barium | 0.07 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Cadmium | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Chromium | 0.08 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Lead | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Mercury | < 0.01 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Selenium | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Silver | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |

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# IAS EnviroChem

3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com


**Kase Warbonnet Inc.**
**Mark R. Smith**
**1477 Thunderbolt**
**Pocatello, ID 83204**

**Date Submitted:** 11/14/2013
**Date Reported:** 12/03/2013

## Certificate of Analysis

**Sample Description:** 111413-SDS
**Lab Tracking #:** I311052-02
**Sampling Date/Time:** 11/14/13 13:55

| Analyte | Result | Units | Method | Analyzed | Analyst |
|---|---|---|---|---|---|
| TCLP Arsenic | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Barium | 0.32 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Cadmium | 0.06 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Chromium | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Lead | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Mercury | < 0.01 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Selenium | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |
| TCLP Silver | < 0.05 | mg/L | 1311/6020A | 11/29/2013 | RP |

G. Ryan Pattie
Laboratory Director

ND = Not Detected
All solids are reported on a dry weight basis unless otherwise noted.

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# IAS EnviroChem

3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com


## Login Report

Customer Name: **Kase Warbonnet Inc.**
**1477 Thunderbolt**
**Pocatello, ID 83204**

Work Order #: **I311052**

Contact Name: **Mark R. Smith**
Comment:

Sample Description: **111413-SDL**
Lab Tracking #: **I311052-01**
Matrix: **Water**
Sample Notes:

Sampling Date/Time: **11/14/13 13:40**
Date Received: **11/14/13 14:25**

| *Test* | *Method* | *Due* |
|---|---|---|
| **pH** | **150.1** | **11/28/13** |
| **TCLP Arsenic** | **1311/6020A** | **11/28/13** |
| **TCLP Barium** | **1311/6020A** | **11/28/13** |
| **TCLP Cadmium** | **1311/6020A** | **11/28/13** |
| **TCLP Chromium** | **1311/6020A** | **11/28/13** |
| **TCLP Lead** | **1311/6020A** | **11/28/13** |
| **TCLP Mercury** | **1311/6020A** | **11/28/13** |
| **TCLP Selenium** | **1311/6020A** | **11/28/13** |
| **TCLP Silver** | **1311/6020A** | **11/28/13** |

Sample Description: **111413-SDS**
Lab Tracking #: **I311052-02**
Matrix: **Solid**
Sample Notes:

Sampling Date/Time: **11/14/13 13:55**
Date Received: **11/14/13 14:25**

| *Test* | *Method* | *Due* |
|---|---|---|
| **TCLP Arsenic** | **1311/6020A** | **11/28/13** |
| **TCLP Barium** | **1311/6020A** | **11/28/13** |
| **TCLP Cadmium** | **1311/6020A** | **11/28/13** |
| **TCLP Chromium** | **1311/6020A** | **11/28/13** |
| **TCLP Lead** | **1311/6020A** | **11/28/13** |
| **TCLP Mercury** | **1311/6020A** | **11/28/13** |
| **TCLP Selenium** | **1311/6020A** | **11/28/13** |
| **TCLP Silver** | **1311/6020A** | **11/28/13** |

## Sample Condition Record

| | |
|---|---|
| Samples received in a cooler? | No |
| Samples received intact? | Yes |
| The temperature recorded? | 19.8 |
| Samples received with a COC? | Yes |
| Samples received within holding time? | Yes |
| Are all samples properly preserved? | Yes |
| Labels and chain agree? | Yes |

1311052
Kase Warbonnet Inc.
Received: 11/14/2013
RP
2 Samples

IAS EnviroChem - 3314 Pole Line Rd • Pocatello, ID 83201
P: (208) 237-3300 F: (208) 237-3336 • Email: iasec3308@iasenvirochem.com

Company Name: KASE/WARBONNET
Address: 1477 Thunderbolt
City: Pocatello Id 83201
Phone: 208-232-6276
Email:

Send Bill or Receipt To: KASE/Warbonnet
Payment due with samples unless credit has been established
Email Invoice to:
☐ Cash ☐ Bill ☐ Check# ☐ PO #
☐ Other
Amount Received by

Special Instructions

Analyses Requested

SAMPLE INFORMATION

| TRK # (Lab use) | Sample Description | Date/Time Collected | Number of Containers | pH | TCLP | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 111413-SDL | 11/14/13 1340 | 1 | X | X | | | | | | | | | | | | |
| | ~~111413 SDS~~ | ~~11/14/13 1355~~ | ~~1~~ | ~~X~~ | ~~X~~ | | | | | | | | | | | | |
| | 111413-SDS | 11/14/13 1355 | 1 | | X | | | | | | | | | | | | |

Comments

RELINQUISHED BY
Signature: Allen Hull
Printed Name: ALLEN HULL
Date/Time: 11-14-13 1425

RECEIVED BY
Signature: KBC
Printed Name: Kaci
Date/Time: 111413 1425

Lab Use Only
Temp: 19.8°C
Labels and Chain Agree? YES NO
Container Sealed? YES NO

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DVD of Stormwater Sewer Piping Video Survey

(included in Hard Copy Reports Only)

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# APPENDIX H

## ProUCL 5.0 Statistical Analysis

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## Normal Background Statistics for Full Data Sets

| | |
|---|---|
| User Selected Options | |
| From File | C:\Users\hartmanrj\Documents\FMC Projects\RD Work Plans\Data Gap WP\Field Data\Geotech data for |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Coverage | 90% |
| Different or Future K Values | 1 |

MDD

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 10 |
| Number of Distinct Observations | 10 |
| Minimum | 97.7 |
| Maximum | 107.2 |
| Second Largest | 107 |
| Mean | 104.2 |
| Geometric Mean | 104.1 |
| First Quartile | 103.8 |
| Median | 104.6 |
| Third Quartile | 106.8 |
| SD | 3.215 |
| Coefficient of Variation | 0.0309 |
| Skewness | -1.211 |

| Normal Distribution Test | |
|---|---|
| Shapiro Wilk Test Statistic | 0.843 |
| 5% Shapiro Wilk Critical Value | 0.842 |

Data appear Normal at 5% Significance Level

| Background Statistics Assuming Normal Distribution | |
|---|---|
| 90% Percentile (z) | 108.3 |
| 95% Percentile (z) | 109.5 |
| 99% Percentile (z) | 111.7 |
| Tolerance Factor K | 2.355 |
| 95% UTL with 90% Coverage | 111.8 |
| 95% UPL (t) | 110.4 |

Average K

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 2.3000E-5 |
| Maximum | 1.4000E-4 |
| Second Largest | 7.8000E-5 |
| Mean | 6.5667E-5 |
| Geometric Mean | 5.5682E-5 |

| | |
|---|---|
| First Quartile | 3.9250E-5 |
| Median | 6.0000E-5 |
| Third Quartile | 7.4000E-5 |
| SD | 4.1563E-5 |
| Coefficient of Variation | N/A |
| Skewness | 1.252 |

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Normal Distribution Test

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.901 |
| 5% Shapiro Wilk Critical Value | 0.788 |

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

| | |
|---|---|
| 90% Percentile (z) | 1.1893E-4 |
| 95% Percentile (z) | 1.3403E-4 |
| 99% Percentile (z) | 1.6236E-4 |
| Tolerance Factor K | 3.006 |
| 95% UTL with 90% Coverage | 1.9060E-4 |
| 95% UPL (t) | 1.5613E-4 |

In-situ Moisture

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 9 |
| Minimum | 4.8 |
| Maximum | 15.5 |
| Second Largest | 15.1 |
| Mean | 8.733 |
| Geometric Mean | 7.987 |
| First Quartile | 5.9 |
| Median | 8.4 |
| Third Quartile | 9.4 |
| SD | 4.071 |
| Coefficient of Variation | 0.466 |
| Skewness | 0.972 |

Normal Distribution Test

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.839 |
| 5% Shapiro Wilk Critical Value | 0.829 |

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

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| | |
|---|---|
| 90% Percentile (z) | 13.95 |
| 95% Percentile (z) | 15.43 |
| 99% Percentile (z) | 18.2 |
| | |
| Tolerance Factor K | 2.454 |
| 95% UTL with 90% Coverage | 18.72 |
| | |
| 95% UPL (t) | 16.71 |

In-situ Density

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 9 |
| Minimum | 70.4 |
| Maximum | 94.7 |
| Second Largest | 90.8 |
| Mean | 81.11 |
| Geometric Mean | 80.82 |
| First Quartile | 77.5 |
| Median | 79.3 |
| Third Quartile | 81.7 |
| SD | 7.368 |
| Coefficient of Variation | 0.0908 |
| Skewness | 0.825 |

Normal Distribution Test

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.895 |
| 5% Shapiro Wilk Critical Value | 0.829 |

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

| | |
|---|---|
| 90% Percentile (z) | 90.55 |
| 95% Percentile (z) | 93.23 |
| 99% Percentile (z) | 98.25 |
| | |
| Tolerance Factor K | 2.454 |
| 95% UTL with 90% Coverage | 99.19 |
| | |
| 95% UPL (t) | 95.55 |

Optimum Moisture

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 10 |
| Number of Distinct Observations | 9 |
| Minimum | 15.9 |
| Maximum | 22.7 |
| Second Largest | 19.4 |

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| | |
|---|---|
| Mean | 17.65 |
| Geometric Mean | 17.56 |
| First Quartile | 16.65 |
| Median | 16.85 |
| Third Quartile | 17.65 |
| SD | 2.024 |
| Coefficient of Variation | 0.115 |
| Skewness | 2.059 |

Normal Distribution Test

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.756 |
| 5% Shapiro Wilk Critical Value | 0.842 |

Data not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

| | |
|---|---|
| 90% Percentile (z) | 20.24 |
| 95% Percentile (z) | 20.98 |
| 99% Percentile (z) | 22.36 |
| Tolerance Factor K | 2.355 |
| 95% UTL with 90% Coverage | 22.42 |
| 95% UPL (t) | 21.54 |

Optimum Moisture w/o outlier

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 8 |
| Minimum | 15.9 |
| Maximum | 19.4 |
| Second Largest | 17.7 |
| Mean | 17.09 |
| Geometric Mean | 17.06 |
| First Quartile | 16.6 |
| Median | 16.8 |
| Third Quartile | 17.5 |
| SD | 1.033 |
| Coefficient of Variation | 0.0604 |
| Skewness | 1.473 |

Normal Distribution Test

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.877 |
| 5% Shapiro Wilk Critical Value | 0.829 |

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

| | |
|---|---|
| 90% Percentile (z) | 18.41 |
| 95% Percentile (z) | 18.79 |
| 99% Percentile (z) | 19.49 |

| | |
|---|---|
| Tolerance Factor K | 2.454 |
| 95% UTL with 90% Coverage | 19.62 |
| | |
| 95% UPL (t) | 19.11 |

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Outlier Tests for Selected Variables

| | |
|---|---|
| User Selected Options | |
| From File | C:\Users\hartmanrj\Documents\FMC Projects\RD Work Plans\Data Gap WP\Field Data\Geote |
| Full Precision | OFF |
| Test for Suspected Outliers with Dixon test | 1 |
| Test for Suspected Outliers with Rosner test | 1 |

Dixon's Outlier Test for Optimum Moisture

Number of data = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597

1. Data Value 22.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.508

For 10% significance level, 22.7 is an outlier.
For 5% significance level, 22.7 is an outlier.
For 1% significance level, 22.7 is not an outlier.

2. Data Value 15.9 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.086

For 10% significance level, 15.9 is not an outlier.
For 5% significance level, 15.9 is not an outlier.
For 1% significance level, 15.9 is not an outlier.

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## Normal Background Statistics for Full Data Sets

| User Selected Options | |
|---|---|
| From File | C:\Users\hartmanrj\Documents\FMC Projects\RD Work Plans\Data Gap WP\Field Data\Root density data |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Coverage | 90% |
| Different or Future K Values | 1 |

0 to 6 inches

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 27 |
| Number of Distinct Observations | 27 |
| Minimum | 0.014 |
| Maximum | 0.118 |
| Second Largest | 0.109 |
| Mean | 0.067 |
| Geometric Mean | 0.0598 |
| First Quartile | 0.0445 |
| Median | 0.068 |
| Third Quartile | 0.088 |
| SD | 0.0285 |
| Coefficient of Variation | 0.425 |
| Skewness | -0.0498 |

| Normal Distribution Test | |
|---|---|
| Shapiro Wilk Test Statistic | 0.973 |
| 5% Shapiro Wilk Critical Value | 0.923 |

Data appear Normal at 5% Significance Level

| Background Statistics Assuming Normal Distribution | |
|---|---|
| 90% Percentile (z) | 0.103 |
| 95% Percentile (z) | 0.114 |
| 99% Percentile (z) | 0.133 |
| Tolerance Factor K | 1.811 |
| 95% UTL with 90% Coverage | 0.119 |
| 95% UPL (t) | 0.116 |

12 to 18 inches

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 25 |
| Number of Distinct Observations | 13 |
| Minimum | 0.003 |
| Maximum | 0.026 |
| Second Largest | 0.023 |
| Mean | 0.014 |
| Geometric Mean | 0.0125 |

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| | |
|---|---|
| First Quartile | 0.013 |
| Median | 0.014 |
| Third Quartile | 0.016 |
| SD | 0.00553 |
| Coefficient of Variation | 0.396 |
| Skewness | -0.11 |
| | |
| Normal Distribution Test | |
| Shapiro Wilk Test Statistic | 0.946 |
| 5% Shapiro Wilk Critical Value | 0.918 |
| Data appear Normal at 5% Significance Level | |
| | |
| Background Statistics Assuming Normal Distribution | |
| 90% Percentile (z) | 0.021 |
| 95% Percentile (z) | 0.023 |
| 99% Percentile (z) | 0.0268 |
| | |
| Tolerance Factor K | 1.838 |
| 95% UTL with 90% Coverage | 0.0241 |
| | |
| 95% UPL (t) | 0.0236 |

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## Gamma Background Statistics for Full Data Sets

| | |
|---|---|
| User Selected Options | |
| From File | C:\Users\hartmanrj\Documents\FMC Projects\RD Work Plans\Data Gap WP\Field Data\Root density data |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Coverage | 90% |
| Number of Bootstrap Operations | 2000 |

6 to 12 inches

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 26 |
| Number of Distinct Observations | 21 |
| Minimum | 0.013 |
| Maximum | 0.078 |
| Second Largest | 0.075 |
| Mean | 0.0337 |
| Geometric Mean | 0.0304 |
| First Quartile | 0.0223 |
| Median | 0.0295 |
| Third Quartile | 0.0395 |
| SD | 0.0167 |

| Gamma Distribution Test | |
|---|---|
| k hat (MLE) | 5.026 |
| k star (bias corrected MLE) | 4.472 |
| Theta Hat (MLE) | 0.0067 |
| Theta star (bias corrected MLE) | 0.00753 |
| nu hat (MLE) | 261.4 |
| nu star (based upon bias corrected estimates) | 232.5 |
| MLE Mean (based upon bias corrected estimates) | 0.0337 |
| MLE Sd (based upon bias corrected estimates) | 0.0159 |
| 95% Percentile of Chisquare (2k) | 16.84 |
| | |
| A-D Test Statistic | 0.497 |
| 5% A-D Critical Value | 0.746 |
| K-S Test Statistic | 0.137 |
| 5% K-S Critical Value | 0.172 |

Data appear Gamma Distributed at 5% Significance Level

| Background Statistics Assuming Gamma Distribution | |
|---|---|
| 90% Percentile | 0.055 |
| 95% Percentile | 0.0634 |
| 99% Percentile | 0.0812 |
| | |
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 0.0643 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 0.0648 |
| | |
| Tolerance Factor K | 1.824 |
| 95% Wilson Hilferty (WH) Approx. Gamma UTL with 90% Coverage | 0.0663 |
| 95% Hawkins Wixley (HW) Approx. Gamma UTL with 90% Coverage | 0.0669 |

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| | |
|---|---|
| Nonparametic Background Statistics | |
| 95% Chebyshev UPL | 0.108 |
| 95% BCA Bootstrap UTL with 90% Coverage | 0.075 |
| 95% Bootstrap (%) UTL with 90% Coverage | 0.0765 |

0 to 12 inches

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 53 |
| Number of Distinct Observations | 44 |
| Minimum | 0.013 |
| Maximum | 0.118 |
| Second Largest | 0.109 |
| Mean | 0.0506 |
| Geometric Mean | 0.0429 |
| First Quartile | 0.028 |
| Median | 0.041 |
| Third Quartile | 0.075 |
| SD | 0.0287 |
| Gamma Distribution Test | |
| k hat (MLE) | 3.169 |
| k star (bias corrected MLE) | 3.002 |
| Theta Hat (MLE) | 0.016 |
| Theta star (bias corrected MLE) | 0.0169 |
| nu hat (MLE) | 335.9 |
| nu star (based upon bias corrected estimates) | 318.2 |
| MLE Mean (based upon bias corrected estimates) | 0.0506 |
| MLE Sd (based upon bias corrected estimates) | 0.0292 |
| 95% Percentile of Chisquare (2k) | 12.6 |
| A-D Test Statistic | 0.602 |
| 5% A-D Critical Value | 0.757 |
| K-S Test Statistic | 0.088 |
| 5% K-S Critical Value | 0.123 |
| Data appear Gamma Distributed at 5% Significance Level | |
| Background Statistics Assuming Gamma Distribution | |
| 90% Percentile | 0.0898 |
| 95% Percentile | 0.106 |
| 99% Percentile | 0.142 |
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 0.107 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 0.109 |
| Tolerance Factor K | 1.628 |
| 95% Wilson Hilferty (WH) Approx. Gamma UTL with 90% Coverage | 0.104 |
| 95% Hawkins Wixley (HW) Approx. Gamma UTL with 90% Coverage | 0.106 |
| Nonparametic Background Statistics | |
| 95% Chebyshev UPL | 0.177 |

| | |
|---|---|
| 95% BCA Bootstrap UTL with 90% Coverage | 0.103 |
| 95% Bootstrap (%) UTL with 90% Coverage | 0.104 |

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2014-03-14 FMC Responses to EPA Comments on the Data Gap Report for the ....pdf

**FMC Responses to EPA Comments, dated and received February 20, 2014, on the Remedial Design (RD) Data Gap Report for the FMC Operable Unit (OU), submitted January 28, 2014**

**March 14, 2014**

## I. General Comment

1. Field activities and results of the investigation were detailed in the Data Gap Report. However, little discussion was provided to indicate how the new soil data will affect ET cover and gamma cap designs (i.e., acceptability of the borrow soil for its intended purpose). It is expected that such details will be provided in the draft design documents for this project and will be reviewed at that time. No change is needed on this document.

   **FMC Response:** The purpose of the Data Gap Report was to summarize the field investigation and results of laboratory testing. The data presented in the Data Gap Report is currently being incorporated into the design of the ET covers. Given that the predominant soil type encountered was silt loess, which exhibits both high moisture capacity and low plasticity, there is nothing to suggest that the WUA is not an acceptable borrow source for cover material.

## II. Specific Comments

<u>Section 1.1, Regulatory Background, page 1-2</u>

1. The last sentence in this section should be revised to include the date on which EPA approved the DGWP. In addition, the October 2013 version of the DGWP should be listed in the references section.

   **FMC Response:** The Data Gap Report has been revised to address this comment.

<u>Section 1.4, Document Organization, page 1-2</u>

2. The first sentence in this section should be revised to refer to the Data Gap Report instead of the DGWP.

   **FMC Response:**
   The Data Gap Report has been revised to address this comment.

<u>Table 2-1, Summary of WUA Soil Investigation, pages 2-1 and 2-2</u>

3. The DGWP called for collection of grab samples of silt at one foot intervals to a depth of 10 feet below ground surface (bgs) in each test pit. However, in several of the test pits, gravel was encountered at depths shallower than 10 feet bgs. Accordingly, the sampling depths indicated in Table 2-1 should be revised to indicate the actual extent of grab sampling conducted (i.e., 4 feet bgs in test pit TP003, 7 feet bgs in test pit TP009, and 6 feet bgs in test pit TP010).

**FMC Response:** Table 3.1 of the Data Gap Work Plan (MWH, 2013) states that disturbed samples will be collected to a total depth of "10 feet or until gravels are contacted". Due to the size of the excavator used at the site, the test pits were able to be excavated to deeper depths up to 20.5 feet. Although samples were not generally collected at depths below 10 feet, the test pits were excavated deeper to provide visual observations and logging at deeper depths. Based on visual evidence of the test pit, it is clear that the soil characteristics of silt are uniform throughout the soil profile until the underlying gravels are contacted. Table 2-1 has been revised to add an additional column titled, "Maximum Depth of Grab Sample."

4. Expand the footnote to this table to indicate that the qualifier NC applies to test pits in which gravels were not contacted before the maximum depth of the excavator was reached.

   **FMC Response:** The footnote has been revised to address the comment.

<u>Section 2.1.1, Test Pits, page 2-24.</u>

5. This section should be expanded to discuss the observed variability in depth to gravel within the WUA. Gravel was not encountered at all in more than half of the test pits (TP002, TP004, TP005, TP006, TP007, and TP008). Conversely, gravel was encountered at relatively shallow depths (between 4 and 7.5 feet bgs) in three of the pits (TP003, TP009, and TP010). As noted in the test pit logs (page 56 of the electronic file), this area of shallow gravel appears to cut from east to west across the center of the WUA study area. Such detail is important because it will affect the available volume of borrow soil in this location.

   **FMC Response:** Comment noted. Figure 4-1, showing the cut isocontour map takes into consideration this east-west trending gravel lense; and therefore, does not factor this portion of the WUA into the volume calculations for available cover soil. Section 2.1.1 has been revised to further explain the presence and extent of the gravels. (See also FMC Response to Comment 17 below.)

6. For consistency with Table 2-1, correct this section to note that test pits were excavated to depths ranging from 4 to 20.5 feet below ground surface (bgs).

   **FMC Response:** Section 2.1.1 has been revised accordingly.

<u>Section 2.1.2, Soil Borings, page 2-3</u>

7. As indicated in the DGWP, undisturbed silt samples were to be collected from five soil borings at depths between 2-3 and 6-8 feet below ground surface (bgs). However, Table 2-1 indicates that the only soil sample from boring SB003 was collected from 0-2 feet bgs. A review of the associated boring log in Appendix C shows that silt was encountered only in the uppermost two feet of this boring. Consequently, no undisturbed soil samples could be collected from the pre-determined depths of 2-3 and 6-8 feet bgs. While this deviation from the DGWP appears to be acceptable, an explanation for it should be provided in the text of the Data Gap Report.

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**FMC Response:** Section 2.1.2 has been revised to indicate that an undisturbed sample of silt was collected from 0 to 2 feet bgs in SB003 due to the presence of gravels below 2 feet at that boring location. In addition, a disturbed sample of gravel was collected from the drilling augers from 2 to 15 feet SB003. This sample was analyzed for hydraulic conductivity for the purposes of designing the potential infiltration basin as part of Groundwater Option B. Table 2-1 has been revised to include this sample, text has been added to Section 2.1.2 to describe the collection of this sample and the hydraulic conductivity result has been added to Table 3.2.

8. As shown in Table 2-1, a silt samples from the 12-14 feet bgs interval was collected from boring SB007. The text indicates that this sample was collected to provide geotechnical information on deeper silts at the WUA. It is unclear whether a single sample will adequately represent properties of deeper silt across the WUA. Given the fact that deep silt was found in numerous test pits and borings across the WUA, it is likely that deep silt will be incorporated into the planned ET and gamma caps. Section 4 of the report should compare shallow and deep silt results (as shown on Table 3-1), and clarify whether any significant differences were evident that may impact design or construction of the ET and gamma caps. If significant differences are identified, additional samples should be collected to determine the usability of deeper silt.

   **FMC Response:** As described in Section 4 of the Data Gap Report, ProUCL statistical analysis was performed on laboratory data from both in-situ and ex-situ samples for maximum dry density and moisture content. Based on the analysis, the data distributions are normal suggesting a uniform soil type. In addition, a review of all particle size distribution (PSD) plots and Atterberg Limits Tests for disturbed samples of the silt further confirms a uniform soil type. It should be noted that index properties such as PSDs and Atterburg Limits are a key indicator of soil type. Additionally, the manner in which these silts were deposited, aeolian, further suggests that the physical properties of the soil with depth will remain consistent. Therefore, further sampling of silts at deeper depths is not warranted. Additional text has been added to Section 4.1 that describes the uniformity of the silt with depth.

9. According to the Table 3.1 of the DGWP, gravel samples were to be collected from the five soil borings at a depth approximately 10 feet beneath the gravel horizon. However, it does not appear that gravel samples were collected from the soil borings for permeability analysis. In fact, Section 2.1.2 of the report indicates that the only one gravel sample collected during this investigation was taken from test pit TP003, and the associated log in Appendix B (page 46 of the electronic file) suggests that the samples was collected from the top of the gravel horizon (i.e., at 4feet bgs, rather than 14 feet bgs). This deviation from the approved DGWP suggests that inadequate gravel data has been obtained. The text of the report should be revised to: (1) document these deviations in the sampling program; (2) discuss whether the single, shallow gravel sample is representative of gravel across the WUA; and (3) explain why additional gravel samples are not needed to meet RD information needs. If sufficient justification cannot be provided, additional gravel samples are recommended.

**FMC Response:** While preparing the Data Gap Work Plan, the depths of gravels were believed to be much shallower, on the order of ±10 feet. However, during the test pitting, the depths of gravel were shown to be generally much deeper than 10 feet throughout the site, with the exception of the shallow east-west gravel lense. The main purpose of the gravel sampling was to determine the hydraulic conductivity of the gravels for the purpose of sizing potential infiltration basins for treated groundwater for groundwater remedy water management option B. Given that the depth of excavation required to obtain the volume of capping soil will in general be much shallower than the underlying gravels, it was determined that the controlling factor in the infiltration basins will be the in-situ hydraulic conductivity of the silts. Therefore, an undisturbed sample of the silts at deeper depth, 12-14 feet bgs, was collected from SB0007 to provide data for this purpose. Further, the gravels that were contacted appeared to be very uniform in terms of shape and size suggesting the hydraulic conductivity of these gravels will be fairly uniform. Therefore, no additional sampling is required at deeper depths for the gravels. Additional text has been added to Section 2.1.2 that incorporates this response.

10. The first sentence in this section should be corrected to note that the five soil borings advanced during this investigation were numbered SB003 through SB008, with the exception of SB005. No soil boring was conducted in the vicinity of test pit TP005.

    **FMC Response:** The text has been revised to address the comment.

<u>Section 2.2.1, Stormwater Sewer Survey Background and Objectives, page 2-3</u>

11. The first paragraph in this section indicates that the selected remedy for RA-A calls for covering the area (and underground storm sewer piping) with a gamma cap. The second paragraph indicates that any segments of the storm sewer pipe that cannot be cleaned within RA-B will be plugged with concrete and covered by an ET cap. Expand this section to identify remedial action objectives (RAOs) for the storm sewer, and confirm that both types of caps will satisfactorily achieve those RAOs.

    **FMC Response:** The relevant RAOs for the underground storm sewer piping in RA-A (and RA-B and RA-K) as taken from Table 4-2 of the Supplemental Feasibility Study Report for the FMC Plant OU – July 2010 (SFS Report) are:

    1. Prevent external exposure to radionuclides in soils at levels that pose estimated excess risk greater than 1 x 10-4, or site-specific background levels where that is not practical.
    2. Prevent ingestion of soils containing COCs at levels that pose estimated excess risks above 1 x 10-4, a non-cancer risk HQ of 1, or site-specific background levels where that is not practical.
    3. Reduce the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding risk-based concentration (RBCs) or chemical specific Applicable or Relevant and Appropriate Requirements (ARARs), specifically Maximum Contaminant Levels (MCLs).

In addition, the following RAO was developed (as presented in Section 7.1.1 of the SFS Report) to address elemental phosphorus (P4) in subsurface soils and underground piping as a principal threat source material (PTSM):

- Prevent direct exposure to P4 under conditions that may spontaneously combust, posing a fire hazard, or resultant air emissions that represent a significant risk to human health and the environment.

Underground storm sewer piping that is successfully cleaned in-place will no longer present a threat to human health and/or the environment as all COCs potentially associated with the storm sewer piping (i.e., P4, radionuclides, metals, and leachable metals posing a threat to groundwater) will have been removed and appropriately disposed. Therefore, cleaned underground storm sewer piping by itself meets all of the above-listed RAOs. While this underground storm sewer piping resides in RA-A, which will be capped with a gamma cap as prescribed in the IRODA, the remedial action for the underground storm sewer piping is independent of the requirement for placement of the gamma cap in RA-A.

While we generally understand that the underground storm sewer piping can be cleaned with readily available technology, a contingency was included in Section 2.2.1 of the Data Gap Report, in the event sections of the piping could not be cleaned. In that event, the ET cap placed over RA-B could be extended over the un-cleaned sections of underground piping. As stated in the SFS Report and accepted in the IRODA, placement of a properly designed ET cap over underground piping would meet all of the above listed RAOs, even with the presumption that radionuclides, metals, and/or P4 remain within the un-cleaned sections of the underground storm sewer piping.

Regardless, at any level of success of cleaning of the underground storm sewer piping in RA-A, the underground piping would be plugged at the boundaries of RA-A with RA-B and RA-K to eliminate a conduit for water moving between the different capped areas.

Section 2.2.1 has been modified to clarify this achievement of the RAOs.

<u>Section 2.2.2, Video Survey Description, pages 2-4 and 2-5</u>

12. This section summarizes results of the storm sewer video survey which, as shown on Figure 2-2, extended across RA-A, RA-B, and RA-K. Each segment in the figure appears to have been addressed except for the one between Area Inlets 1 and 3. Confirm the status of surveying over this area and modify the Data Gap Report accordingly.

    **FMC Response:** The Data Gap report has been revised to better clarify that while historical plant drawings indicate that the piping segment from Area Inlet #1 to Area Inlet #3 exists, visual investigation of the vault at Area Inlet #1 did not reveal the presence of a pipe entering from the south – only a pipe running towards the north to the East Discharge. Similarly, visual investigation of the vault at Area Inlet #3 only revealed pipes connected on the south side (from Manhole #1) and west side (toward Area Inlet #4); no pipe leaving to the north towards Area Inlet #1 was present. Whether the

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historical drawing was incorrect or had not been updated to reflect later removal of the pipe segment cannot be determined; regardless, there is no observable evidence that a segment of piping is present between Area Inlet #3 and Area Inlet #1. Therefore, this segment was not present to survey. The figure has been revised to indicate this piping segment is not present and a bullet has been added at the end of Section 2.2.2 that incorporates this response into the text.

Section 3.1.2, Hydrological Testing, page 3-1

13. According to Table 3.2 of the DGWP, disturbed soil samples from every other test pit were to be sampled for saturated hydraulic conductivity (ASTM D5084) at 85 and 90% of the maximum dry density (MDD) level. Thus, ten samples would undergo conductivity testing. Ten water characteristic curve tests (ASTM D6836) – two tests on every other test pit sample – were also slated for completion. However, Table 3-2 of the report suggests that only five test pit samples were subjected to these analyses. A review of Appendix D indicates that all five of the test pit samples were analyzed at 85% MDD, and that no data are available for conductivity at 90% MDD. These deviations from the work plan should be noted in the text, along with an explanation as to why these changes should not be considered lingering data gaps for the investigation.

    **FMC Response:** The DGWP specified that Soil Water Characteristic Curve Testing would be performed on disturbed samples remolded to both 85 and 90% of MDD. However, Water Characteristic Curve Testing was performed only on disturbed samples remolded to 85% MDD. The deviation was mainly due to the fact that the construction specifications for the cover soil (silt from the WUA) would target an in-place density of 85% MDD ±3%. This specification has been chosen to limit the in-place density to below 90% MDD. Therefore, Water Characteristic Curve Testing at 90% MDD was not warranted. Section 3.1.2 has been revised to describe and justify this deviation from the Work Plan.

Section 3.2, Root Density Testing, pages 3-4 through3-6

14. Appendix F shows that root density testing was performed on depth-specific samples collected from three locations in each of nine grids across the existing vegetable trial plot. Expand Table 3.4 of the report to also show root density results for Grid 16, Location 3; all three locations within Grid 17, and all three locations within Grid 18 (provided on page 178 of the electronic file). In addition, correct the last sentence on page 3-6 to refer to the 6- to 12-inch interval at Grid 8, which was not analyzed because it was compromised during shipping. Finally, describe the incident in which this sample was compromised and detail what was done to ensure that none of the other samples had been similarly affected.

    **FMC Response:** Table 3.4 has been revised to list the additional samples from Grids 16, 17, and 18. The last paragraph of Section 3.2 has been revised to correct the reference to Grid 8 and explain that the sample bag was reported as torn when received at the laboratory and was evidently damaged during shipment.

Section 4.1, Geotechnical Recommendations, page 4-1

15. This section should be expanded to discuss results pertaining to the susceptibility of WUA soils to erosion and desiccation cracking, as determined during the data gap investigation. The discussion should also indicate whether the majority of WUA soils are sufficiently nondispersive for purposes of cap construction. Any limitations on use of WUA borrow soil identified as dispersive (i.e., rating a 3 via the Crumb Test) should also be specified.

    **FMC Response:** Additional text related to the erosion and desiccation potential of the WUA soils has been added to Section 4.1. Atterberg limits and dispersive testing was performed on the majority of disturbed samples to assess the potential for desiccation cracking and erosion of the silts. Based on the Atterberg limits testing, the plasticity index (PI), ranged between 1 and 14. These results indicate that the soils have very low-plasticity and therefore are not susceptible to desiccation cracking associated with volumetric changes (shrinkage) induced by moisture fluctuations. The results of the dispersion testing both (Crumb and double hydrometer testing) indicate that the soils are generally non-dispersive to moderately dispersive based on Crumb test results characterizing the majority of samples being between a Grade 1(non-dispersive) and 2 (Intermediate) and double hydrometer testing ranging between 18.6 and 44.3-percent dispersion. Therefore, based on these results, there is nothing to preclude the WUA soils being used as capping soil.

Section 4.3, Root Density Recommendations, page 4-2

16. Statistical analyses presented in Appendix H indicated depth-specific root density mean values (expressed as grams of dry root material per 100 grams of soil) of:
    - 0.067 grams in the 0-6 inch sampling interval;
    - 0.0337 grams in the 6-12 inch sampling interval; and
    - 0.014 grams in the 12-18 inch sampling interval.

    A statistical evaluation of all 53 soil samples collected from the 0-6 and 6-12 inch intervals yielded a mean root density value of 0.051 grams. As noted in Section 4.3, this value was selected as the design root density value to be used in RD development. However, it is unclear why results from the 12-18 inch sampling interval were not included in this analysis. If root density below the uppermost foot of soil is not considered an important factor for cap design, it is unclear why soil samples were even collected from the deeper intervals for root density analysis. Expand the text to provide justification for these omissions and to explain how use of the selected design value will affect establishment of an adequate vegetative cover layer on the ET and gamma caps.

    **FMC Response:** Samples collected below 6-12 inches were not factored into the statistical analysis because the cover design assumes the bulk of root density is within the upper 12-inches. This is a conservative assumption given that there were roots present below 12-inches. However, due to the sparser aerial distribution of the 12-18-inch soil thickness at the re-vegetation test area, these data were not included in the statistical analysis. No changes to the text are warranted.

Section 4.5, Borrow Source Availability, page 4-2

17. This section states that approximately 2.4 million cubic yards of silt are available at the WUA for use in the ET and gamma covers. However, this estimate is unsupported by mathematical calculations or software output. Instead, this estimate was reportedly based on Figure 4-1, an isocontour map showing the depth of silt in the WUA. However, this figure is confusing, with contour lines that are unlabeled and difficult to translate into depths. It is possible that a different visual approach (e.g., using shades of color to represent silt thickness) would facilitate interpretation of Figure 4-1. Moreover, it does not appear that the figure accounted for soils deemed unusable due to dispersivity or other considerations. Revise the figure to provide for better interpretation, and provide calculations demonstrating how the figure was determined.

    **FMC Response:** Figure 4-1 has been revised to change it from an isocontour to an isopach drawing to show color shading associated with depths of excavation. Note that the borrow availability assessment excludes from consideration the area in the vicinity of the shallow gravels. Additionally, there is no evidence to preclude any silt soils from being used as borrow material based on dispersion or desiccation potential. No changes to the text are warranted.

Table 4.3, Summary of Stormwater Sewer Piping Video Survey, page 4-3

18. After adding in sediment and other solids present between Area Inlets 1 and 3 (as discussed in Specific Comment 12 above), this table should be identified as a conservative estimate of solids to be removed from the storm sewer in areas RA-A, RAB, and RA-K. Relatively clear areas noted in Section 2.2.2 of the report (i.e., the first 40 feet in the segment from the east discharge pipe toward Area Inlet 1 and the first 55 feet in the segment from Manhole 1 to Area Inlet 3) do not appear to have been subtracted out of the volume calculations in this table.

    **FMC Response:** As stated in response to Comment 12 above, the piping segment between Area Inlets 1 and 3 has been determined to no longer be present based on visual investigations in the vaults at both Area Inlet 1 and Area Inlet 3. Therefore, this segment was not included in Table 4.3. Also, column 6 (*Percent full of Sediment*) is an estimated average over the total length of the piping segment. A footnote has been added to Table 4.3 to indicate that the calculated "maximum" sediment volumes are a conservative estimate for waste management planning purposes.